

Operations & Maintenance Cost Study for NASA Facilities

Final Report for Warehouse Facilities

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Operations & Maintenance Cost Study for NASA Facilities: Final Report for Warehouses

Overview

National Aeronautics and Space Administration (NASA) requires a credible method for estimating the operations and maintenance (O&M) requirements of its facilities.¹ The failure to anticipate future costs can lead to under-funding and diminished service life.

NASA has over 1,100 buildings totaling 18.4 million GSFT distributed at 33 sites globally in the selected inventory for this project. It is not cost effective to inspect all facilities, yet NASA needs detailed sustainment and operations estimates to support its budget planning. This project developed cost models for a sample of NASA assets with inventory details collected through site surveys. Estimates were extrapolated by facility type and size and adjusted for location to generate requirements for the selected NASA inventory.

The project employed the MARS Facility Cost Forecast System to provide cost information. Now in its eighth version, MARS is a facility cost modeling tool developed by CBRE | Whitestone and used by many federal and commercial agencies.

Phases 1, 2, and 3 of this project estimated O&M costs for five facility types: Administration Buildings, Propulsion Buildings, Communications/Data Centers, Space Science (R&D and Test) Buildings, and Wind Tunnels. Sample buildings were chosen at Goddard and Marshall Space Flight Centers and Glenn Research Center. CBRE | Whitestone submitted formal reports for each facility type.

Phase 3A inspected a sample of five Warehouse facilities at Langley Research Center (LaRC) in Hampton, Virginia and Plum Brook Station (PBS) in Sandusky, OH and generated detailed models in MARS. Site inspections at LaRC were conducted by Jacobs Facilities, a long-time CBRE | Whitestone partner experienced in inspecting federal facilities and creating MARS component inventories. A team consisting of an architect, and electrical and mechanical engineers carried out the facility inspections. A component inventory for a typical PBS Igloo facility was also provided to create a model for the facility type. O&M estimates from the sample were extrapolated to the population of Warehouses in the NASA inventory by Classification Type and size.

This report describes the project methodology and presents final estimates for the Warehouse facilities in the NASA inventory.

Project Methodology

Parametric Estimates for Buildings

The project methodology entailed estimating O&M requirements for the selected NASA inventory based on the inspection and modeling of a sample of facilities. The project included four key steps:

¹ Operations include custodial (cleaning, pest control, and trash collection), utilities (energy, water, and sewer), grounds (landscape care, mowing, and snow removal), security, telecommunications, and management. Maintenance (also known as sustainment) includes preventative maintenance, minor repair, unscheduled maintenance, and renewal and replacement.

1. Validate the existing NASA inventory and develop a sample
2. Perform on-site inspections of the sample buildings
3. Develop and calibrate MARS models
4. Generate per square foot estimates of sustainment and operations costs for the sample and extrapolate to the project inventory

Study Sample

NASA has over 1,100 buildings at 33 sites globally in the selected inventory. Complete inspection of each site to estimate O&M requirements is impractical and costly. This project generated sustainment and operations estimates for a sample of buildings and extrapolated the costs to a selected NASA inventory.

NASA and CBRE | Whitestone selected five Warehouse facilities at Langley Research Center and Plum Brook Station as a representative sample of the population of NASA Warehouses. The project sample included the inspection of one small Covered Storage building, one small non-temperature controlled General Warehouse, one small temperature controlled Dehumidified Warehouse, and one large Receiving and Shipping building. Inspections were performed at LaRC to minimize travel costs. Plum Brook Station provided component information for a typical Igloo facility to create a model for the facility type. Component-level cost models were developed for the five Warehouse facilities using CBRE | Whitestone's MARS. O&M costs will be generated for the sample and extrapolated to the remaining inventory. Estimates for Administration, Propulsion, Communications, Space Science (R&D and Test) Buildings, and Wind Tunnels were generated in Phases 1, 2, and 3 of the project.

Table 1 shows the building detail for the inspected Warehouses.

Table 1. Warehouse Facilities Inspection Sample							
Site	Classification	Property ID	Property No.	Property Name	Year Built	Size	CRV
Langley Research Center	Covered Storage (Miscellaneous)	350	1265H	1265 COMPLEX	1981	1,517	\$91,020
	Dehumidified Warehouse - Ready Issue	46	1175	STORAGE FACILITY	1988	3,448	\$223,719
	General Warehouse - Ready Issue	212	1240	STORAGE FACILITY	1951	6,246	\$367,378
	Receiving and Shipping Buildings	153	1206	DISTRIBUTION CENTER	1966	35,625	\$3,639,735
Plum Brook Station	General Warehouse - Ready Issue	N/A	N/A	IGLOO	1942	1,953	\$309,368
Total						48,789	\$4,631,220

There are a number of variables that drive O&M costs. In Phases 1 and 2 of the project, building Classification Type and size were the key inputs used to determine appropriate mapping of sample facilities to the total inventory. An alternative sample may control for current replacement value (CRV), age, and location. Per square foot estimates were generated for the sample and extrapolated to the selected inventory by type (Administration, Propulsion, Communications, and Space Science (R&D and Test) Buildings) and size. In Phase 3, the unique systems and function of the Wind Tunnels prevented O&M costs from closely aligning with facility square footage. NASA and CBRE | Whitestone defined several variables and

associated factors used to map the sample models and extrapolate total O&M costs to the remainder of the inventory.

Similarities in Warehouse construction across the NASA inventory allow for an extrapolation methodology consistent with Phases 1 and 2. Classification Type and size were used to map the sample Warehouse facilities to the population of assets. Per square foot O&M estimates for the five Warehouses will be extrapolated to the individual mapped facilities and adjusted for location to generate costs for the entire NASA inventory.

Warehouse facilities represent 4.6 million GSFT with a \$680 million CRV. Table 2 shows the Warehouse inventory by site.

Table 2. NASA Warehouse Facilities by Site			
Site	Count	Size	CRV
AMES Research Center	12	286,982	\$22,015,817
ARC Camp Parks	1	120,264	\$6,991,699
CAPE	16	82,005	\$19,868,559
Columbia Scientific Balloon Facility	3	7,188	\$350,600
Dryden Flight Research Center	10	74,329	\$8,239,018
Ellington Field (JSC)	7	52,563	\$5,179,917
Glenn Research Center	11	66,797	\$19,633,945
GODDARD SPACE FLIGHT CENTER	9	362,218	\$44,573,625
HAWAII STDN STATION	2	1,159	\$32,035
Jet Propulsion Laboratory	8	19,600	\$3,062,033
Johnson Space Center	57	328,626	\$34,817,504
JPL/Australia - Canberra Deep Space Comm.	3	6,868	\$1,466,102
JPL/Goldstone - Apollo Site	1	184	\$373,723
JPL/Goldstone - Echo Site	1	1,705	\$373,723
JPL/Goldstone - Mars Site	1	184	\$373,723
JPL/Goldstone - Venus Site	3	1,514	\$510,989
JPL/Spain - Madrid Deep Space Comm.	8	26,794	\$3,433,836
Kennedy Space Center	99	859,813	\$103,341,925
Langley Research Center	25	178,204	\$22,774,088
Marshall Space Flight Center	44	391,021	\$55,542,708
Michoud Assembly Facility	8	362,882	\$107,962,385
Moffett Federal Airfield	30	107,701	\$9,584,578
NASA/JSC/White Sands Test Facility	11	37,969	\$2,940,629
Plum Brook Station	112	261,813	\$46,302,279
Stennis Space Center	8	202,639	\$49,040,438
Stennis Space Center (MSAAP)	55	573,114	\$87,022,126
Stennis Space Center (Tenants)	10	50,539	\$5,030,853
Wallops Flight Facility	37	140,818	\$19,301,223
Total	592	4,605,493	\$680,140,080

Detailed cost models were developed for the four buildings using CBRE | Whitestone's MARS Facility Cost Forecast System.

Description of the MARS Model

CBRE | Whitestone used MARS to estimate preventative maintenance, unscheduled maintenance, repair, and renewal/replacement costs for this project. MARS is an asset management system that estimates both deferred maintenance and future requirements on the basis of asset components and their scheduled maintenance and repair. It also estimates costs for ten operations types in the typical commercial chart of accounts. MARS was originally developed in 1996, and is currently in its eighth version. It is used by many government agencies and commercial concerns.

Sustainment	Preventive Maintenance & Minor Repair Unscheduled Maintenance Renewal & Replacement
Operations	Custodial Energy Grounds Management Pest Control Refuse Road Clearance Security Telecom Water/Sewer

Note that the definition of future M&R requirements is the same as the “sustainment” requirements used for programming by DoD and an approach endorsed in a National Research Council (NRC) study of Department of Energy facility practices.² Among other agencies, the MARS Facility Cost Forecast System has been used to forecast budgets for the IRS, FAA, USDA, and CDC. It was recently used to benchmark costs for the Department of State Overseas Embassies. MARS is also the basis for the DoD Sustainment Model and a study for NNSA validating total life-cycle facility costs at eight nuclear weapons production and research sites.³ The model is used continuously to simulate alternative facility costs for the U.S. nuclear complex.

The MARS process begins with a component inventory of a building or structure. Derived from building plans, equipment inventory data, and on-site inspections, these components are organized into UNIFORMAT category level three elements and are identified specifically in terms of product characteristics, quantity, and output level; e.g. “Single-Ply Modified

² National Research Council, *Intelligent Sustainment and Renewal of Department of Energy Facilities and Infrastructure*, 2004. P. 44.

³ Jacobs Facilities and Whitestone Research, *Implementation of the Department of Defense Sustainment Model, Final Report*, May 2002.

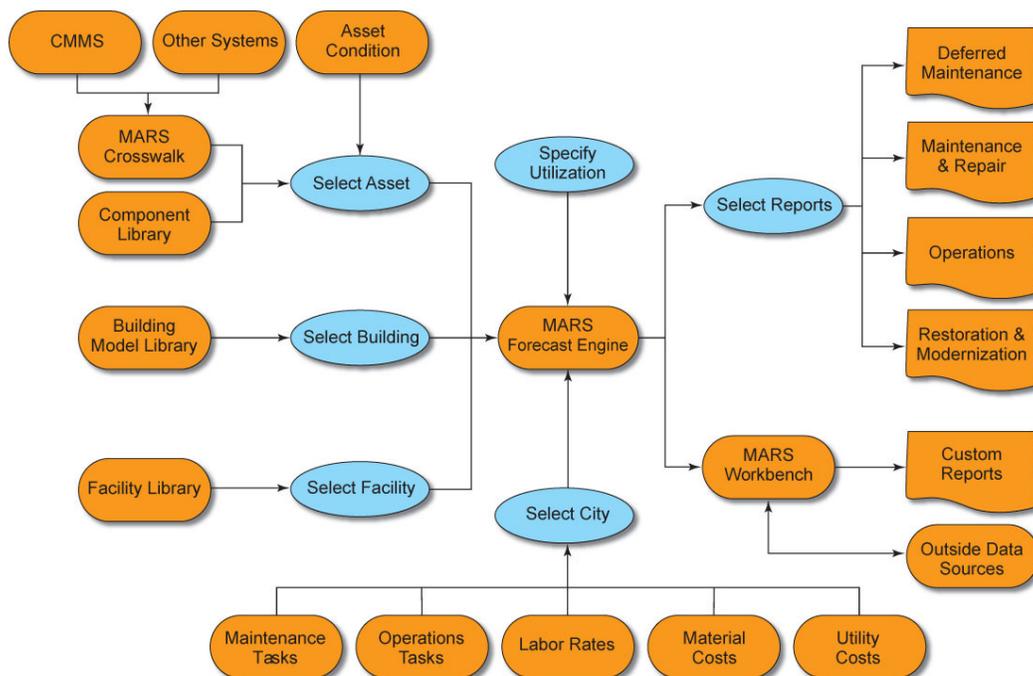
Bituminous/Thermoplastic Roof,” “Condenser, Air-Cooled, 60 Ton,” or “Pipe & Fittings, ¾” Copper.”

Once the component inventory is completed, the MARS system relates maintenance tasks from a pre-defined task library to each selected component. New components and related tasks are defined as necessary. The frequency of each task determines the forecast of future required maintenance. MARS estimates four types of maintenance: preventative maintenance, unscheduled maintenance (service calls), repair, and renewal/replacement tasks. Tasks and their labor and material requirements are pre-defined by CBRE | Whitestone, but are also editable.

Other calibration steps include modifying default values for contract and in-house labor rates, specifying site-typical mark-up for contract expenditures, and identifying the utilization characteristics for each asset.

The sources for local wage rates and benefits are primarily the U.S. Department of Labor and Davis-Bacon Act labor agreements, and private sector employers. Both union and non-union wages are considered in determining prevailing rates by locality. State and local wage surveys are also used when available.

MARS Facility Cost Forecast System



MARS is also used to estimate operations costs other than maintenance and repair. These are based on the Facilities Operation Model developed jointly by the Department of Defense (DOD) and CBRE | Whitestone. This model provides costs for ten services, including those mentioned in the Federal Real Property Council (FRPC) guidance—utilities, cleaning and janitorial, and

roads and grounds.⁴ Each operation type for an asset can be calibrated for a level of service (low, medium, high) to reflect the level of demand or frequency at which certain operations task are performed.

The CBRE | Whitestone operations cost models provides estimates for the following services:

Custodial. The custodial function represents the expense of cleaning offices, work areas, restrooms and common areas. Costs include local wage rates and benefits, task productivity, mark-ups for equipment, materials, supervision, and assumptions concerning the level of service. Trash removal costs are not included. Custodial service levels are defined by altering the combination and frequency of common tasks.

Energy. Energy includes all expenses related to the purchase, generation, distribution, and conservation of energy and source fuels necessary to operate an asset. The main energy sources considered are electricity and natural gas. Not included are utilities maintenance and supervision, and utility tax rates. Service levels vary according to estimated commodity demand by asset use type.

Grounds. The grounds function includes any expense related to the maintenance of exterior landscaping. It does not include sweeping or the maintenance of signage, parking lots and roadways. Costs are estimated using local wage rates and benefits, task productivity, mark-ups for equipment, materials and supervision, and assumptions concerning the level of service. Service levels are defined by altering the combination and frequency of common tasks.

Management. The real property management function describes all costs associated with facility management, including: public works, contracts, material procurement, facility data, furnishings, real estate, and engineering services. Costs are expressed as a fixed percentage of Plant Replacement Value. Service levels are based on the distribution of costs found in institutional and commercial settings. For this project, the level of service for all NASA buildings was set to low to reflect economies of scale in a campus environment.

Pest Control. Pest control expenses cover indoor and outdoor pest control programs, separate from the grounds function. Costs are based on the frequency of common tasks for rodent and insect abatement and inspections. Costs include prevailing labor and material rates. Service levels are defined by altering the combination and frequency of common tasks.

Refuse. Refuse costs include all expenses related to trash collection and disposal, pick-up services, fees, recycling operations and administration, composting, etc. Costs exclude handling and disposal of HAZMAT materials. Service levels vary according to estimated demand by asset use type.

Road Clearance. The road clearance function includes all expenses related to sweeping paved areas including sidewalks, walkways, and parking lots. Costs include prevailing labor and material rates, and climatic variables. Service levels are defined by altering the combination and frequency of common tasks.

⁴ Federal Real Property Council. *Guidance for Real Property Inventory Reporting*. Washington, D.C. August, 2012.

Security. Security expenses relate to the physical security of assets and occupants, and include personnel, operating and monitoring security equipment. Costs include relevant prevailing labor and material rates. Service levels are defined by altering the combination and frequency of common tasks and services.

Telecommunications. Telecommunication expenses cover the purchase of all the services ordinarily associated with commercial activities, such as voice and data equipment and service subscription. The level of telecommunications is defined by the combination of services selected.

Water and Sewer. Water and Sewer expenses include all costs related to providing the asset with potable water, irrigation water, and sewage service. Estimates include local commodity costs. Service levels vary according to estimated commodity demand by asset use type.

Data Collection and Calibration

MARS Model Development

The technical work for this task involved the definition of the component inventory for the five sample Warehouses. Langley Research Center staff supplied existing equipment inventories and construction design documents before the inspection. Jacobs Facilities inspected the buildings and created draft models in MARS. Plum Brook Station also provided component information for a typical Igloo facility to create a model for the facility type. In total, 226 MARS components were defined for the five facilities.

Jacobs submitted the MARS database to CBRE | Whitestone for a detailed component-by-component review. Three areas of focus included:

- 1) Check for completeness. Review the wall finishes (exterior and interior), roofing, plumbing, HVAC, fire protection, and electrical data to ensure the building model contains the appropriate components in each category.
- 2) Check for consistency. Review the building gross square feet for accuracy. Ensure the square footage of structural components (exterior walls, roofing system, interior finishes) are reasonable compared to building GSFT. Verify the capacity of the following is consistent with the building type and size:
 - Heating, cooling, and air distribution
 - Electrical service, distribution, and lighting
 - Plumbing fixtures and water distribution
 - Fire protection
- 3) Forecast review. Run the following building-level MARS reports and look for extraordinary costs (high or low) illustrating an error in the building model:
 - Average M&R Costs
 - Most Costly M&R Tasks

- Deferred Maintenance Detail
- Operation Cost Summary

We also compared the costs with known resources (*The Whitestone Facility Maintenance and Repair* and *Operations Cost References*, comparable CBRE | Whitestone project work with federal agencies, and third party sources).

Attachments A through E provide detailed MARS component lists for the inspected Warehouse facilities at LaRC and the Plum Brook Station Igloo model.

CBRE | Whitestone also collected information to calibrate the models for local site values.

Local Calibration of MARS

While the MARS system has pre-defined building models, labor and material costs, utility rates, and an extensive component library, all of these values can be changed or supplemented to reflect the actual site practices.

Calibration data was gathered to adjust MARS factors for maintenance & repair and operations costs of the Warehouses. Data was gathered at both the site and the building level. Site-level information, such as labor and utility rates, was directly used to estimate O&M costs for the Warehouses at LaRC and PBS. Building-level calibration data was applied to the sample models and then extrapolated to the remaining NASA inventory.

The following data was collected to calibrate the building models:

Maintenance and Repair. A default assumption in MARS assigns in-house labor to preventative maintenance, minor repair, and unscheduled maintenance, while contract labor performs major repair and replacement tasks. NASA staff indicated all maintenance was performed by contract laborers. CBRE | Whitestone adjusted the MARS database accordingly.

NASA personnel specified laborers must be paid prevailing wages for the area. We used the default MARS wage rates for this study, and included a 30 percent mark-up for contract overhead.

Table 3 shows the source of the maintenance and repair factors for each site.

Table 3. Data Sources by Site, Maintenance & Repair					
Site	In-house Shop Rates	In-house Markup Rates	Contract Labor Rates	Contract Overhead Rates	Utilization
Langley Research Center	N/A	N/A	WST	WST	Site
Plum Brook Station	N/A	N/A	WST	WST	Site
WST = Whitestone, Site = Respective NASA Site, N/A = Not applicable, no in-house maintenance staff					

MARS estimates also can be adjusted to reflect utilization factors that impact M&R. For example, many NASA facilities have special safety requirements which increase costs relative to conventional commercial practice. Other special requirements include high or low hours of operation and security. Langley Research Center defined utilization factors for the four sample Warehouse facilities.

Table 4 displays the average utilization multipliers for the sample Warehouses used to adjust for these requirements.

Table 4. Average Utilization Adjustment by Site^A				
Site	Hours of Operation^B	Security^C	Safety & Permitting^D	Sum^E
Langley Research Center	1.00	1.00	1.00	1.00
Plum Brook Station	1.00	1.00	1.00	1.00

^A Calculated from individual asset multipliers assigned by the sites.
^B Hours of Operation rates building use on a weekly basis and is defined as follow s: 0.80 = 40 hours, 1.00 = 41 to 80 hours, 1.37 = 80+ hours.
^C Security is defined as follow s: 1.00 = free access, 1.01 = contractor training & daily check-in, 1.15 = full contractor accompaniment.
^D Safety & Permitting is defined as follow s: 1.00 = typical commercial & service activity, 1.07 = non-specific laboratory, 1.75 = radiological or life science research, 3.00 = nuclear facility.
^E In combination the multipliers are additive such that the total multiplier = $1 + \sum (\beta - 1)$ where β = the multiplier value.

Operations. MARS also estimates operations costs for ten services including: custodial, energy, grounds, management, pest control, refuse, road clearance, security, telecommunications, and water & sewer. Key drivers of operations estimates include utility rates, labor rates, and mark-ups, which were collected from LaRC and PBS staff.

In addition, MARS is populated with default levels of service by operation and building type. Each sample model was calibrated in terms of the level of service (low, medium, high, or none). The ratings reflect the level of utility demand or frequency of operations tasks in the facility. NASA staff defined levels of service for all operation types and also provided several utility rates.

Other utility rates, such as refuse, provided in Phase 1, 2, and 3 were significantly lower than the default MARS commercial rates. These discounts are often provided to large federal property holders like NASA. NASA staff provided utility rates for the remaining sites in the Warehouses inventory.

As with M&R, CBRE | Whitestone used the default MARS wage rates and a 30 percent mark-up for contract overhead.

Table 5 shows the source of the operations calibration data.

Table 5. Data Sources by Site, Operations											
Site	Level of Service	Custodial Wage	Refuse Rates	Energy Rates	Water/Sewer Rates	Groundskeeper Wage	Pest Control Wage	Road Clearance Wage	Security Rates	Property Management	Telecom Rates
Langley Research Center	Site	WST	Site	Site	Site	WST	WST	WST	WST	Site	WST
Plum Brook Station	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site

WST=Whitestone, Site = Respective NASA Site

Cost Estimates for Warehouse Facilities

Sustainment Costs

Detailed sustainment estimates for the small Covered Storage building, small non-temperature controlled General Warehouse, small temperature controlled Dehumidified Warehouse, and large Receiving and Shipping building are show in the MARS reports in Attachments A through E.

The sample estimates were extrapolated to the population. Table 6 shows sustainment costs by site for all Warehouses. Sustainment estimates are expressed as 30, 40, and 50-year averages. While CBRE | Whitestone computes annual requirements, average costs are presented to smooth the annual oscillations. Overall, the sustainment requirements are an average of \$16.6 million per year over 50 years, or \$3.59 per GSFT. Expressed another way, this amounts to 2.4 percent of the \$680 million replacement value.

Table 6. Average Annual Estimates of Sustainment Requirements by Site, Warehouse Facilities

Site	GSFT	CRV	Sustainment ^A								
			30-Year Estimates			40-Year Estimates			50-Year Estimates		
			Avg. Annual Estimate	Per GSFT	Percent CRV	Avg. Annual Estimate	Per GSFT	Percent CRV	Avg. Annual Estimate	Per GSFT	Percent CRV
AMES Research Center	286,982	\$22,015,817	\$1,647,951	\$5.74	7.5%	\$1,532,945	\$5.34	7.0%	\$1,602,658	\$5.58	7.3%
ARC Camp Parks	120,264	\$6,991,699	\$755,034	\$6.28	10.8%	\$702,299	\$5.84	10.0%	\$698,074	\$5.80	10.0%
CAPE	82,005	\$19,868,559	\$259,811	\$3.17	1.3%	\$241,050	\$2.94	1.2%	\$239,003	\$2.91	1.2%
Columbia Scientific Balloon Facility	7,188	\$350,600	\$14,501	\$2.02	4.1%	\$13,348	\$1.86	3.8%	\$14,222	\$1.98	4.1%
Dryden Flight Research Center	74,329	\$8,239,018	\$187,580	\$2.52	2.3%	\$175,202	\$2.36	2.1%	\$167,947	\$2.26	2.0%
Ellington Field (JSC)	52,563	\$5,179,917	\$163,277	\$3.11	3.2%	\$151,171	\$2.88	2.9%	\$151,637	\$2.88	2.9%
Glenn Research Center	66,797	\$19,633,945	\$243,099	\$3.64	1.2%	\$225,862	\$3.38	1.2%	\$256,810	\$3.84	1.3%
GODDARD SPACE FLIGHT CENTER	362,218	\$44,573,625	\$1,831,828	\$5.06	4.1%	\$1,703,419	\$4.70	3.8%	\$1,699,924	\$4.69	3.8%
HAWAII STDN STATION	1,159	\$32,035	\$3,434	\$2.96	10.7%	\$3,212	\$2.77	10.0%	\$5,735	\$4.95	17.9%
Jet Propulsion Laboratory	19,600	\$3,062,033	\$51,626	\$2.63	1.7%	\$47,956	\$2.45	1.6%	\$71,073	\$3.63	2.3%
Johnson Space Center	328,626	\$34,817,504	\$1,176,911	\$3.58	3.4%	\$1,094,674	\$3.33	3.1%	\$1,144,629	\$3.48	3.3%
JPL/Australia - Canberra Deep Space Comm.	6,868	\$1,466,102	\$14,779	\$2.15	1.0%	\$13,618	\$1.98	0.9%	\$15,180	\$2.21	1.0%
JPL/Goldstone - Apollo Site	184	\$373,723	\$511	\$2.78	0.1%	\$478	\$2.60	0.1%	\$853	\$4.64	0.2%
JPL/Goldstone - Echo Site	1,705	\$373,723	\$4,734	\$2.78	1.3%	\$4,427	\$2.60	1.2%	\$7,906	\$4.64	2.1%
JPL/Goldstone - Mars Site	184	\$373,723	\$511	\$2.78	0.1%	\$478	\$2.60	0.1%	\$853	\$4.64	0.2%
JPL/Goldstone - Venus Site	1,514	\$510,989	\$3,635	\$2.40	0.7%	\$3,334	\$2.20	0.7%	\$2,991	\$1.98	0.6%
JPL/Spain - Madrid Deep Space Comm.	26,794	\$3,433,836	\$46,379	\$1.73	1.4%	\$42,972	\$1.60	1.3%	\$58,692	\$2.19	1.7%
Kennedy Space Center	859,813	\$103,341,925	\$2,875,850	\$3.34	2.8%	\$2,672,673	\$3.11	2.6%	\$2,764,840	\$3.22	2.7%
Langley Research Center	178,204	\$22,774,088	\$556,743	\$3.12	2.4%	\$517,458	\$2.90	2.3%	\$552,545	\$3.10	2.4%
Marshall Space Flight Center	391,021	\$55,542,708	\$1,341,387	\$3.43	2.4%	\$1,245,145	\$3.18	2.2%	\$1,269,248	\$3.25	2.3%
Michoud Assembly Facility	362,882	\$107,962,385	\$1,633,545	\$4.50	1.5%	\$1,519,140	\$4.19	1.4%	\$1,513,603	\$4.17	1.4%
Moffett Federal Airfield	107,701	\$9,584,578	\$421,965	\$3.92	4.4%	\$391,880	\$3.64	4.1%	\$478,294	\$4.44	5.0%
NASA/JSC/White Sands Test Facility	37,969	\$2,940,629	\$109,856	\$2.89	3.7%	\$101,820	\$2.68	3.5%	\$103,081	\$2.71	3.5%
Plum Brook Station	261,813	\$46,302,279	\$504,715	\$1.93	1.1%	\$416,015	\$1.59	0.9%	\$365,442	\$1.40	0.8%
Stennis Space Center	202,639	\$49,040,438	\$888,029	\$4.38	1.8%	\$826,065	\$4.08	1.7%	\$822,607	\$4.06	1.7%
Stennis Space Center (MSAAP)	573,114	\$87,022,126	\$1,886,170	\$3.29	2.2%	\$1,742,935	\$3.04	2.0%	\$1,938,519	\$3.38	2.2%
Stennis Space Center (Tenants)	50,539	\$5,030,853	\$124,171	\$2.46	2.5%	\$114,474	\$2.27	2.3%	\$106,817	\$2.11	2.1%
Wallops Flight Facility	140,818	\$19,301,223	\$410,344	\$2.91	2.1%	\$382,677	\$2.72	2.0%	\$497,447	\$3.53	2.6%
Total^B	4,605,493	\$680,140,080	\$17,158,377	\$3.73	2.5%	\$15,886,726	\$3.45	2.3%	\$16,550,631	\$3.59	2.4%

^A Sustainment is the average annual sum of preventative maintenance, unscheduled maintenance, and major repair and replacement tasks.

^B All costs expressed in \$2012.

Operation Costs

Estimates of ten operation costs are shown in Table 7. In total, the operation requirements for the selected Warehouses are an annual average of \$10.3 million, or \$2.24 per GSFT and 1.5 percent of replacement value. Note that in commercial accounting M&R (sustainment) is often included as an operating cost, but is reported separately above.

Site	Operations Type ^A													Per GSFT	Percent CRV
	GSFT	CRV	Custodial	Energy	Grounds	Management	Pest Control	Refuse	Road Clearance	Security	Telecom	Water/Sewer	Total Costs		
AMES Research Center	286,982	\$22,015,817	\$107,715	\$154,247	\$49,984	\$55,040	\$42,772	\$1,739	\$0	\$190,493	\$103,389	\$11,736	\$717,114	\$2.50	3.3%
ARC Camp Parks	120,264	\$6,991,699	\$52,492	\$51,132	\$20,949	\$17,479	\$17,924	\$808	\$0	\$60,728	\$45,594	\$5,287	\$272,393	\$2.26	3.9%
CAPE	82,005	\$19,868,559	\$18,516	\$31,665	\$10,123	\$49,671	\$8,315	\$373	\$0	\$41,186	\$24,472	\$3,302	\$187,623	\$2.29	0.9%
Columbia Scientific Balloon Facility	7,188	\$350,600	\$605	\$2,749	\$761	\$877	\$638	\$53	\$0	\$4,649	\$1,266	\$33	\$11,629	\$1.62	3.3%
Dryden Flight Research Center	74,329	\$8,239,018	\$8,322	\$29,230	\$13,664	\$20,598	\$7,187	\$191	\$0	\$40,876	\$11,612	\$933	\$132,612	\$1.78	1.6%
Ellington Field (JSC)	52,563	\$5,179,917	\$9,345	\$22,917	\$6,371	\$12,950	\$4,968	\$595	\$0	\$28,525	\$13,242	\$1,705	\$100,619	\$1.91	1.9%
Glenn Research Center	66,797	\$19,633,945	\$14,491	\$20,599	\$7,078	\$49,085	\$5,265	\$67	\$5,350	\$56,441	\$20,048	\$1,602	\$180,025	\$2.70	0.9%
GODDARD SPACE FLIGHT CENTER	362,218	\$44,573,625	\$164,886	\$161,695	\$45,416	\$111,434	\$49,408	\$2,119	\$5,601	\$194,118	\$132,843	\$26,624	\$894,143	\$2.47	2.0%
HAWAII STDN STATION	1,159	\$32,035	\$69	\$2,032	\$213	\$80	\$164	\$9	\$0	\$2,084	\$358	\$10	\$5,019	\$4.33	15.7%
Jet Propulsion Laboratory	19,600	\$3,062,033	\$1,464	\$6,185	\$3,602	\$7,655	\$1,894	\$50	\$0	\$24,975	\$4,866	\$96	\$50,788	\$2.59	1.7%
Johnson Space Center	328,626	\$34,817,504	\$68,492	\$130,796	\$39,832	\$87,044	\$31,058	\$1,366	\$0	\$210,152	\$98,313	\$10,957	\$678,008	\$2.06	1.9%
JPL/Australia - Canberra Deep Space Comm.	6,868	\$1,466,102	\$697	\$8,417	\$886	\$3,665	\$586	\$78	\$0	\$7,005	\$1,869	\$77	\$23,281	\$3.39	1.6%
JPL/Goldstone - Apollo Site	184	\$373,723	\$8	\$58	\$34	\$934	\$18	\$0	\$0	\$329	\$57	\$1	\$1,439	\$7.82	0.4%
JPL/Goldstone - Echo Site	1,705	\$373,723	\$72	\$538	\$313	\$934	\$165	\$4	\$0	\$3,049	\$526	\$8	\$5,611	\$3.29	1.5%
JPL/Goldstone - Mars Site	184	\$373,723	\$8	\$58	\$34	\$934	\$18	\$0	\$0	\$329	\$57	\$1	\$1,439	\$7.82	0.4%
JPL/Goldstone - Venus Site	1,514	\$510,989	\$193	\$478	\$278	\$1,277	\$146	\$4	\$0	\$658	\$227	\$7	\$3,269	\$2.16	0.6%
JPL/Spain - Madrid Deep Space Comm.	26,794	\$3,433,836	\$2,872	\$25,786	\$3,394	\$8,585	\$2,319	\$247	\$199	\$35,401	\$6,407	\$166	\$85,375	\$3.19	2.5%
Kennedy Space Center	859,813	\$103,341,925	\$202,392	\$340,455	\$106,131	\$258,355	\$87,175	\$4,113	\$0	\$520,760	\$280,127	\$38,059	\$1,837,567	\$2.14	1.8%
Langley Research Center	178,204	\$22,774,088	\$32,565	\$73,200	\$19,513	\$56,935	\$18,452	\$668	\$1,082	\$122,801	\$47,965	\$3,904	\$377,085	\$2.12	1.7%
Marshall Space Flight Center	391,021	\$55,542,708	\$88,521	\$167,050	\$48,861	\$138,857	\$26,172	\$1,786	\$893	\$231,727	\$114,600	\$5,099	\$823,566	\$2.11	1.5%
Michoud Assembly Facility	362,882	\$107,962,385	\$127,494	\$291,934	\$47,424	\$269,906	\$35,015	\$6,045	\$0	\$182,187	\$134,272	\$22,948	\$1,117,224	\$3.08	1.0%
Moffett Federal Airfield	107,701	\$9,584,578	\$20,064	\$37,310	\$18,753	\$23,961	\$16,053	\$420	\$0	\$107,279	\$29,758	\$1,689	\$255,287	\$2.37	2.7%
NASA/JSC/White Sands Test Facility	37,969	\$2,940,629	\$7,799	\$11,648	\$3,632	\$7,352	\$3,780	\$73	\$272	\$21,274	\$10,290	\$259	\$66,379	\$1.75	2.3%
Plum Brook Station	261,813	\$46,302,279	\$12,048	\$21,161	\$8,741	\$115,756	\$5,398	\$53	\$5,484	\$34,328	\$14,330	\$2,156	\$219,455	\$0.84	0.5%
Stennis Space Center	202,639	\$49,040,438	\$72,829	\$168,182	\$23,879	\$122,601	\$16,702	\$1,070	\$0	\$101,632	\$75,538	\$5,722	\$588,153	\$2.90	1.2%
Stennis Space Center (MSAAP)	573,114	\$87,022,126	\$122,946	\$187,409	\$60,710	\$217,555	\$42,103	\$2,081	\$0	\$430,927	\$166,939	\$7,549	\$1,238,219	\$2.16	1.4%
Stennis Space Center (Tenants)	50,539	\$5,030,853	\$8,355	\$20,394	\$5,955	\$12,577	\$4,167	\$144	\$0	\$22,548	\$9,918	\$387	\$84,445	\$1.67	1.7%
Wallops Flight Facility	140,818	\$19,301,223	\$18,533	\$69,864	\$15,415	\$48,253	\$14,578	\$1,473	\$855	\$159,739	\$41,491	\$4,770	\$374,972	\$2.66	1.9%
Total^B	4,605,493	\$680,140,080	\$1,163,794	\$2,037,187	\$561,947	\$1,700,350	\$442,439	\$25,630	\$19,734	\$2,836,202	\$1,390,371	\$155,086	\$10,332,741	\$2.24	1.5%

^A Operations include custodial (cleaning, pest control, and trash collection), utilities (energy, water, and sewer), grounds (landscape care, mowing, and snow removal), security, telecommunications, and management.
^B All costs expressed in \$2012.

Total O&M Costs

Estimated total annual Warehouses costs are shown in Table 8. A combination of maintenance and repair (sustainment) and operations, these costs represent an annual average for the next 50 years. Total costs are an estimated \$26.9 million per year, or can also be expressed as \$5.84 per GSFT and 4.0 percent of CRV.

Table 8. Total Annual Costs by Site, Warehouse Facilities

Site	GSFT	CRV	O&M Estimates		Total Costs	Per GSFT	Percent CRV
			50-Year Avg. Sustainment ^A	Annual Operations ^B			
AMES Research Center	286,982	\$22,015,817	\$1,602,658	\$717,114	\$2,319,773	\$8.08	10.5%
ARC Camp Parks	120,264	\$6,991,699	\$698,074	\$272,393	\$970,467	\$8.07	13.9%
CAPE	82,005	\$19,868,559	\$239,003	\$187,623	\$426,626	\$5.20	2.1%
Columbia Scientific Balloon Facility	7,188	\$350,600	\$14,222	\$11,629	\$25,851	\$3.60	7.4%
Dryden Flight Research Center	74,329	\$8,239,018	\$167,947	\$132,612	\$300,559	\$4.04	3.6%
Ellington Field (JSC)	52,563	\$5,179,917	\$151,637	\$100,619	\$252,255	\$4.80	4.9%
Glenn Research Center	66,797	\$19,633,945	\$256,810	\$180,025	\$436,835	\$6.54	2.2%
GODDARD SPACE FLIGHT CENTER	362,218	\$44,573,625	\$1,699,924	\$894,143	\$2,594,067	\$7.16	5.8%
HAWAII STDN STATION	1,159	\$32,035	\$5,735	\$5,019	\$10,754	\$9.28	33.6%
Jet Propulsion Laboratory	19,600	\$3,062,033	\$71,073	\$50,788	\$121,861	\$6.22	4.0%
Johnson Space Center	328,626	\$34,817,504	\$1,144,629	\$678,008	\$1,822,638	\$5.55	5.2%
JPL/Australia - Canberra Deep Space Comm.	6,868	\$1,466,102	\$15,180	\$23,281	\$38,461	\$5.60	2.6%
JPL/Goldstone - Apollo Site	184	\$373,723	\$853	\$1,439	\$2,292	\$12.46	0.6%
JPL/Goldstone - Echo Site	1,705	\$373,723	\$7,906	\$5,611	\$13,517	\$7.93	3.6%
JPL/Goldstone - Mars Site	184	\$373,723	\$853	\$1,439	\$2,292	\$12.46	0.6%
JPL/Goldstone - Venus Site	1,514	\$510,989	\$2,991	\$3,269	\$6,260	\$4.13	1.2%
JPL/Spain - Madrid Deep Space Comm.	26,794	\$3,433,836	\$58,692	\$85,375	\$144,067	\$5.38	4.2%
Kennedy Space Center	859,813	\$103,341,925	\$2,764,840	\$1,837,567	\$4,602,406	\$5.35	4.5%
Langley Research Center	178,204	\$22,774,088	\$552,545	\$377,085	\$929,630	\$5.22	4.1%
Marshall Space Flight Center	391,021	\$55,542,708	\$1,269,248	\$823,566	\$2,092,814	\$5.35	3.8%
Michoud Assembly Facility	362,882	\$107,962,385	\$1,513,603	\$1,117,224	\$2,630,827	\$7.25	2.4%
Moffett Federal Airfield	107,701	\$9,584,578	\$478,294	\$255,287	\$733,581	\$6.81	7.7%
NASA/JSC/White Sands Test Facility	37,969	\$2,940,629	\$103,081	\$66,379	\$169,460	\$4.46	5.8%
Plum Brook Station	261,813	\$46,302,279	\$365,442	\$219,455	\$584,897	\$2.23	1.3%
Stennis Space Center	202,639	\$49,040,438	\$822,607	\$588,153	\$1,410,761	\$6.96	2.9%
Stennis Space Center (MSAAP)	573,114	\$87,022,126	\$1,938,519	\$1,238,219	\$3,176,738	\$5.54	3.7%
Stennis Space Center (Tenants)	50,539	\$5,030,853	\$106,817	\$84,445	\$191,262	\$3.78	3.8%
Wallops Flight Facility	140,818	\$19,301,223	\$497,447	\$374,972	\$872,419	\$6.20	4.5%
Total^C	4,605,493	\$680,140,080	\$16,550,631	\$10,332,741	\$26,883,371	\$5.84	4.0%

^A Sustainment is the average annual sum of preventative maintenance, unscheduled maintenance, and major repair and replacement tasks.
^B Operations include custodial (cleaning, pest control, and trash collection), utilities (energy, water, and sewer), grounds (landscape care, mowing, and snow removal), security, telecommunications, and management.
^C All costs expressed in \$2012.

Attachment A: Detailed MARS Reports for LaRC Property ID 350

Average M&R Costs

Whitestone Research

Building:	1265 Complex	GSFT:	1,517
Building Number:	1265H	PRV:	\$91,020
Facility:	Langley Research Center	Built Date:	1981
City:	Hampton, VA		

M&R Average Annual Cost Forecasts

	Current Year	5 Year	20 Year	50 Year
PM & Minor Repair:	\$473	\$526	\$492	\$488
Unscheduled Maintenance:	\$489	\$513	\$487	\$483
Renewal & Replacement:	\$737	\$1,641	\$2,697	\$4,902
Total M&R Costs:	\$1,699	\$2,680	\$3,676	\$5,873
Per GSFT:	\$1.12	\$1.77	\$2.42	\$3.87
As % of PRV:	0.12%	0.18%	0.25%	0.40%

Building Component List

Whitestone Research

Building: 1265 Complex

Year Built: 1981

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1265H

City: Hampton, VA

Replacement Value: \$91,020

per SF: \$60

Building Gsft: 1,517

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B2010		Steel, Painted, Exterior, 1st Floor	1981	2185 Sq Ft		
B2020		Aluminum Operable Window, 12 sf, 1st Floor	1981	4 Each		
B2030		Steel Single 12'x12', Painted, Roll-up Door	1981	2 Each		
B2030		Steel, Exterior Door	1981	2 Each		
B3010		Aluminum Gutter, Downspouts, Fittings	1981	0.45 K Ln Ft		
B3010		Metal Roof	1981	1520 Sq Ft		
B3020		Roof Skylight, 20 sf	1981	4 Each		
C3020		Concrete Flooring	1981	1517 Sq Ft		
C3030		Metal Ceiling	1981	1517 Sq Ft		
D2040		Aluminum Gutter, Downspouts, Fittings	1981	0.23 K Ln Ft		
D3040		Exhaust Fan, Propeller, 800 Cfm	1981	1 Each		
D4030		Fire Extinguisher	2010	1 Each		
D5010		Disconnect Switch, 30 Amp.	1981	1 Each		
D5020		Metal Halide Lighting Fixture, Wall Mount, 150 w	1981	2 Each		
D5020		Receptacle, 120 V, 15 Amp.	1981	10 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

23-Dec-14

Page 1

Building Extended Component List with Remaining Service Life

Whitestone Research 23-Dec-14

Building: 1265 Complex
Facility: Langley Research Center
City: Hampton, VA

Year Built: 1981
Original Cost: \$1
Replacement Value: \$91,020 **per SF:** \$60

Building Type: Non-Temperature Control
Building Num: 1265H
Building Gsft: 1,517

Uniformat	Asset Description	Component		Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
B2010		Steel, Painted, Exterior, 1st Floor	1981	42	2185 Sq Ft					
B2020		Aluminum Operable Window, 12 sf, 1st Floor	1981	42	4 Each					
B2030		Steel Single 12'x12', Painted, Roll-up Door	1981	2	2 Each					
B2030		Steel, Exterior Door	1981	42	2 Each					
B3010		Aluminum Gutter, Downspouts, Fittings	1981	-13	0.45 K Ln Ft	\$2,745	\$0	\$2,745		
B3010		Metal Roof	1981	7	1520 Sq Ft					
B3020		Roof Skylight, 20 sf	1981	7	4 Each					
C3020		Concrete Flooring	1981	42	1517 Sq Ft					
C3030		Metal Ceiling	1981	42	1517 Sq Ft					
D2040		Aluminum Gutter, Downspouts, Fittings	1981	-13	0.23 K Ln Ft	\$6,810	\$0	\$6,810		
D3040		Exhaust Fan, Propeller, 800 Cfm	1981	-14	1 Each	\$874	\$0	\$874		
D4030		Fire Extinguisher	2010	8	1 Each					
D5010		Disconnect Switch, 30 Amp.	1981	17	1 Each					
D5020		Metal Halide Lighting Fixture, Wall Mount, 150	1981	-13	2 Each	\$1,041	\$0	\$1,041		
D5020		Receptacle, 120 V, 15 Amp.	1981	-13	10 Each	\$417	\$0	\$417		

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Forecast Year: 2013

M&R Costs by System per Year Chart

Building: 1265 Complex

Facility: Langley Research Center

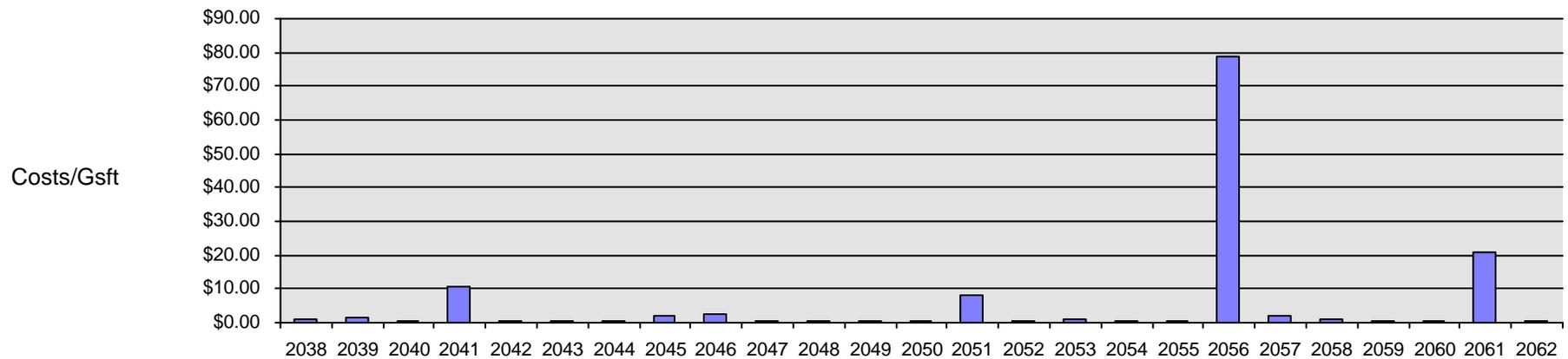
City: Hampton, VA

Building Num: 1265H

GSFT: 1517

Forecast Year: 2038 9 0 1 2 2043 4 5 6 7 2048 9 0 1 2 2053 4 5 6 7 2058 9 0 1 2 **Total**

A10 Foundations																									0.00	
A20 Basement Construction																									0.00	
B10 Super Structure																									0.00	
B20 Exterior Enclosure																									67.84	
B30 Roofing	0.40	1.36	0.40	2.46	0.40	0.40	0.40	1.36	0.63	0.40	0.40	0.40	0.40	1.59	0.40	0.40	0.40	0.40	0.63	1.36	0.40	0.40	14.26	0.40	57.95	
C10 Interior Construction																									0.00	
C20 Stairs																									0.00	
C30 Interior Finishes																									34.91	
D10 Conveying																									0.00	
D20 Plumbing	0.12	0.12	0.12	4.49	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	4.49	0.12	19.29	
D30 HVAC	0.58	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.21	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.58	0.09	0.09	0.09	0.09	6.31	
D40 Fire Protection																									1.00	
D50 Electrical	0.03	0.03	0.03	1.07	0.03	0.03	0.03	0.03	0.18	0.03	0.03	0.03	0.03	0.53	0.03	0.03	0.03	0.03	0.18	0.03	0.03	0.03	0.03	1.07	0.03	6.31
E10 Equipment																									0.00	
E20 Furnishings																									0.00	
F10 Special Construction																									0.00	
F20 Selective Bldg Demolition																									0.00	
G10 Site Preparation																									0.00	
G20 Site Improvements																									0.00	
G30 Site Mechanical Utilities																									0.00	
G40 Site Electrical Utilities																									0.00	
G90 Other Site Construction																									0.00	
Total	1.12	1.63	0.63	10.76	0.63	0.63	0.66	2.08	2.32	0.63	0.63	0.76	0.63	8.18	0.63	1.12	0.63	0.63	78.67	2.08	0.83	0.63	0.63	21.01	0.63	193.62



Notes: A value of "0.00" means cost of more than \$.000 but less than \$.005 per gsft. All costs expressed in (\$) 2012 per gsft. Year 26-50 Based on a 50-Year Forecast.

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: 1265 Complex

Facility: Langley Research Center

Building Num: 1265H

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Maintain Exhaust Fan, Propeller, 800 Cfm	91	91	91	91	91	91		91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
Repair Exhaust Fan, Propeller, 800 Cfm	188											188														
Replace Exhaust Fan, Propeller, 800 Cfm	874																									

D40 Fire Protection

Inspect & Test Fire Extinguisher	32			32			32			32												
Replace Fire Extinguisher	295											295										

D50 Electrical

Replace Receptacle, 120 V, 15 Amp.	417																								
Maintain Disconnect Switch, 30 Amp.	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Repair Disconnect Switch, 30 Amp.	125																								
Replace Disconnect Switch, 30 Amp.												333													
Replace Lamp, Metal Halide Lighting Fixture, Wall Mount, 150	192						192						192						192						
Replace Ballast, Metal Halide Lighting Fixture, Wall Mount, 150												401													
Replace Metal Halide Lighting Fixture, Wall Mount, 150 w	1,041																								

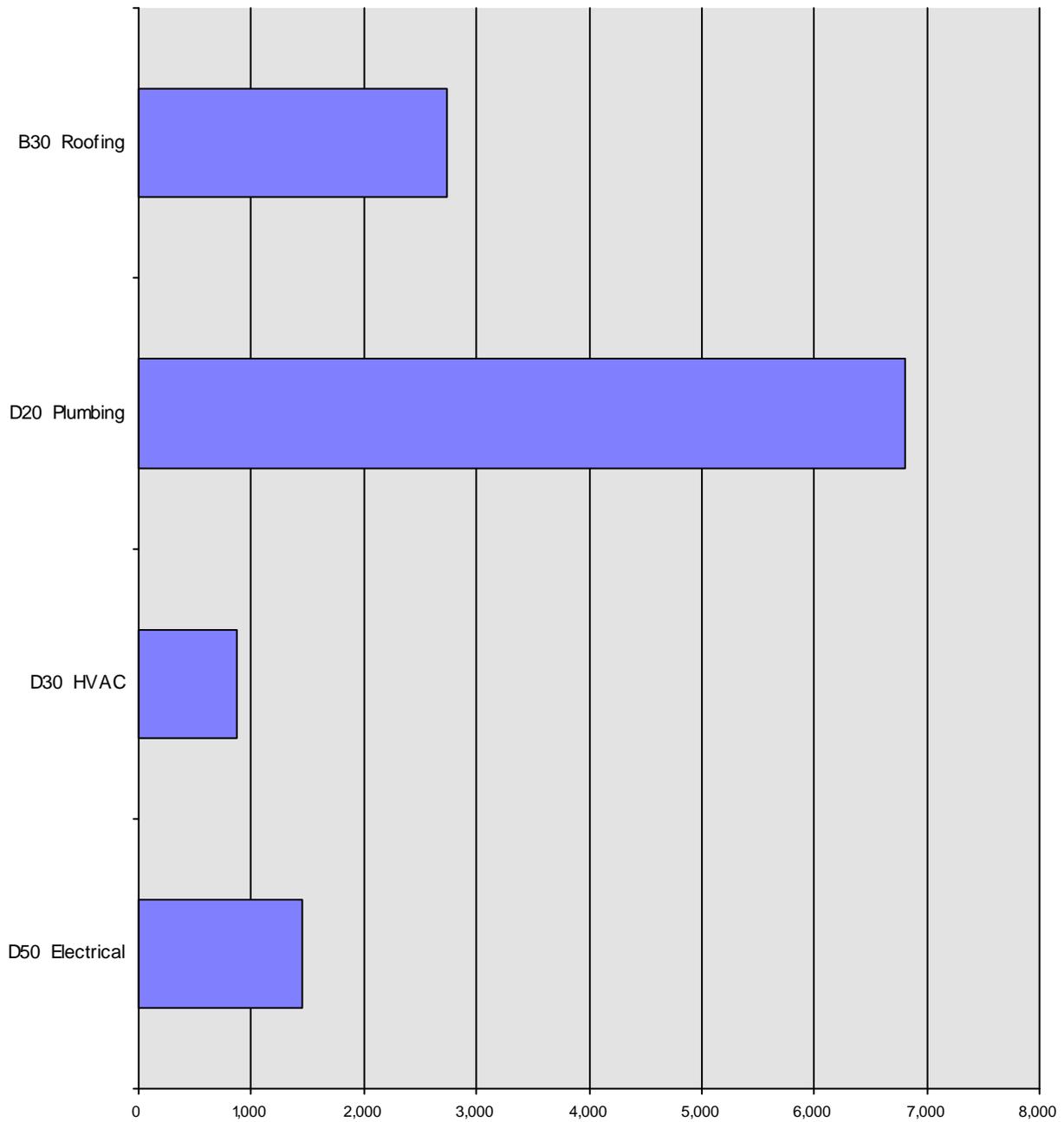
Building Deferred Maintenance by System Chart

Whitestone Research

Building: 1265 Complex

Building Num: 1265H

City: Hampton, VA



All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral and is included in Total Deferred Maintenance.

Based on a 50-Year Forecast.

23-Dec-14

Building Deferred Maintenance Detail

Whitestone Research

Building: 1265 Complex

Year Built: 1981

Building Type: Non- Temperature Controlled

Facility: Langley Research Center

Original Cost: \$1

City: Hampton, VA

Replacement Value: \$91,020
per SF: \$60

Building Gsft: 1,517
Building Number: 1265H

Year Installed	Years Deferred	Deferred Maintenance Task*	Deferred* Maintenance	Degradation Cost**	Total Deferred Maintenance
1981	12	Replace Aluminum Gutter, Downspouts, Fittings	\$6,810	\$0	\$6,810
1981	12	Replace Aluminum Gutter, Downspouts, Fittings	\$2,745	\$0	\$2,745
1981	12	Replace Metal Halide Lighting Fixture, Wall Mount, 150 w	\$1,041	\$0	\$1,041
1981	13	Replace Exhaust Fan, Propeller, 800 Cfm	\$874	\$0	\$874
1981	12	Replace Receptacle, 120 V, 15 Amp.	\$417	\$0	\$417
Total			\$11,887	\$0	\$11,887

All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

Based on a 50-Year Forecast.

23-Dec-14

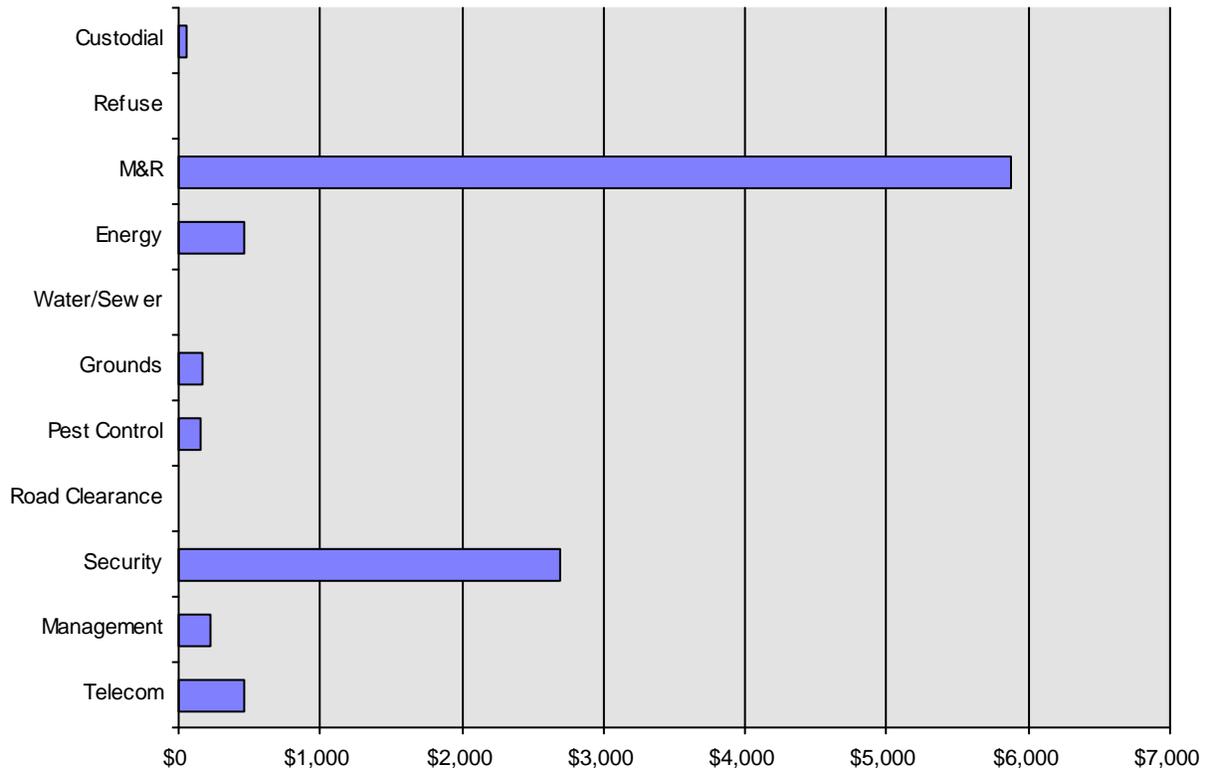
Operation Costs Summary

Whitestone Research

Building: 1265 Complex
Building Number: 1265H
Facility: Langley Research Center
City: Hampton, VA
Built Date: 1981

GSFT: 1,517
Replacement Value: \$91,020
Building Use: Warehouse and Storage
Building Type: Non-Temperature Controlled Warehouse

Operation	Annual Cost/GSFT	Annual Total	Percent
Custodial	\$0.034	\$52	0.5%
Energy	\$0.301	\$456	4.5%
Grounds	\$0.109	\$166	1.6%
M&R	\$3.872	\$5,874	58.1%
Management	\$0.150	\$228	2.3%
Pest Control	\$0.104	\$157	1.6%
Refuse	\$0.002	\$4	0.0%
Road Clearance	\$0.006	\$9	0.1%
Security	\$1.773	\$2,690	26.6%
Telecom	\$0.309	\$468	4.6%
Water/Sewer	\$0.004	\$6	0.1%
Building Total	\$6.66	\$10,111	100.0%



Building Operations Utility Details

Whitestone Research

Building: 1265 Complex

Year Built: 1981

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1265H

City: Hampton, VA

Replacement Value: \$91,020

per SF: \$60

Building Gsft: 1,517

	Utility	GSFT	Demand	UM	Rate	Cost
Operation: Energy	Level of Service: Low					
	Electricity	1517	3.717	kWh	\$0.0700	\$395
	Natural Gas	1517	0.054	Thm	\$0.7480	\$62
	Diesel	1517	0.000	Gal	\$3.1876	\$0
	Total:		3.771			\$456
Operation: Refuse	Level of Service: Low					
	Municipal Solid Waste	1517	0.030	Lbs	\$0.0674	\$3
	Recycling	1517	0.010	Lbs	\$0.0348	\$1
	Total:		0.040			\$4
Operation: Water/Sewer	Level of Service: Low					
	Water	1517	0.560	Gal	\$0.0056	\$5
	Sewer	1517	0.440	Gal	\$0.0023	\$2
	Total:		1.000			\$6

Building Operations Task Details

Whitestone Research

Building: 1265 Complex

Year Built: 1981

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1265H

City: Hampton, VA

Replacement Value: \$91,020

per SF: \$60

Building Gsft: 1,517

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Custodial		Level of Service: Low			
Warehouse	1517	Sweep Hard Floor with 48" Push Broom	\$27	\$4	\$32
Warehouse	1517	Empty Trash; Wipe Clean & Re-line Basket	\$18	\$3	\$20
Total:			\$45	\$7	\$52
Operation: Grounds		Level of Service: Low			
Grounds, Improved	910	Mow Turfgrass with 21" Power Mower	\$32	\$13	\$45
Grounds, Improved	910	Aerate Improved Grounds	\$22	\$9	\$31
Grounds, Improved	910	Clear Shrubs	\$18	\$8	\$26
Grounds, Improved	910	Edge Clean & Trim Walks with Gas Powered Edger	\$13	\$5	\$19
Grounds, Improved	910	Overseed, Improved Grounds	\$11	\$4	\$15
Grounds, Improved	910	Vacuum with 30" Billy Goat	\$7	\$3	\$10
Grounds, Improved	910	Clear Crabgrass	\$5	\$2	\$8
Grounds, Improved	910	Clear Weeds with 15" Boom, Improved Grounds	\$3	\$1	\$4
Grounds, Improved	910	Trim Around Raised Objects with String Edger	\$3	\$1	\$4
Grounds, Improved	910	Fertilize Improved Grounds	\$2	\$1	\$3
Grounds, Improved	910	Sweep with 30" Power Rake	\$1	\$1	\$2
Grounds, Improved	910	Fertilize Using Power Take Off Broadcast	\$0	\$0	\$0
Total:			\$117	\$49	\$166
Operation: Pest Control		Level of Service: Medium			
Pest Controlled	1517	Install, or Check and Re-Bait 5 Rodent Boxes	\$54	\$23	\$77
Pest Controlled	1517	Perform Crawling Insect Abatement	\$41	\$17	\$58
Pest Controlled	1517	Inspect Building for Pests	\$23	\$0	\$23
Total:			\$118	\$39	\$157
Operation: Road Clearance		Level of Service: Medium			
Pavement NASA	1213	Plow Paved Area	\$7	\$2	\$9
Total:			\$7	\$2	\$9

All costs expressed in (\$) 2012.

23-Dec-14

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Security		Level of Service: Low			
Secured Area	1517	Patrol Building Perimeter	\$0	\$0	\$0
Secured Area	1517	Guard Lobby/Parking	\$0	\$0	\$0
Total:			\$0	\$0	\$0

Building Operations Service Details

Whitestone Research

Building: 1265 Complex

Year Built: 1981

FTEs: 1

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1265H

City: Hampton, VA

Replacement Value: \$91,020

per SF: \$60

Building Gsft: 1,517

		Service*	Quantity	Rate	Cost
Operation:	Security	Level of Service: Low			
		Access Control	1	\$2,690	\$2,690
		Total:			\$2,690
Operation:	Telecom	Level of Service: Low			
		Local Telephone	1	\$468	\$468
		Total:			\$468

Building Operations Management Details

Whitestone Research

Building: 1265 Complex

Year Built: 1981

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1265H

City: Hampton, VA

Replacement Value: \$91,020

per SF: \$60

Building Gsft: 1,517

	Service	Demand	UM	PRV	Cost
Operation: Management	Level of Service: Low				
	Management	0.3%	PRV	\$1,454,251	\$3,636
	Total:				\$3,636

Attachment B: Detailed MARS Reports for LaRC Property ID 46

Average M&R CostsWhitestone Research

Building:	Storage Facility	GSFT:	3,448
Building Number:	1175	PRV:	\$223,719
Facility:	Langley Research Center	Built Date:	1988
City:	Hampton, VA		

M&R Average Annual Cost Forecasts

	Current Year	5 Year	20 Year	50 Year
PM & Minor Repair:	\$2,791	\$2,826	\$2,678	\$2,701
Unscheduled Maintenance:	\$1,823	\$1,812	\$1,724	\$1,746
Renewal & Replacement:	\$3,258	\$959	\$5,886	\$4,500
Total M&R Costs:	\$7,872	\$5,597	\$10,288	\$8,947
Per GSFT:	\$2.28	\$1.62	\$2.98	\$2.59
As % of PRV:	3.52%	2.50%	4.60%	4.00%

Building Component List

Whitestone Research

Building: Storage Facility

Year Built: 1988

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1175

City: Hampton, VA

Replacement Value: \$223,719

per SF: \$65

Building Gsft: 3,448

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B2010		Steel, Painted, Exterior, 1st Floor	1988	4050 Sq Ft		
B2030		Steel, 10'x8', Painted, Overhead Coiling Door, Motorized	1988	1 Each		
B2030		Steel, Painted, Insulated, Exterior Door	1988	1 Each		
B3010		Aluminum Gutter, Downspouts, Fittings	1988	0.45 K Ln Ft		
B3010		Metal Roof	1988	3500 Sq Ft		
C3020		Concrete Flooring	1988	3448 Sq Ft		
D3050	Bard Manufacturing M#	Heat Pump, 3 Ton	1988	2 Each		4 Ton Through the wall type
D3060		Thermostat	1988	2 Each		
D4010		Fire Alarm Control Panel	1988	1 Each		
D4030		Fire Extinguisher	2010	2 Each		
D5010		Disconnect Switch, 30 Amp.	1988	4 Each		
D5010		Power Panel Board, 208 Y/120 V, 200 Amp.	1988	2 Each		
D5010		Secondary Transformer, Dry, 112-1/2 kVA	1988	1 Each		
D5020		Emergency Lighting Pack, 2 Light w/ Battery	2000	1 Each		
D5020		Exit Lighting Fixture, w/ Battery	2000	1 Each		
D5020		Fluorescent Lighting Fixture, T8, 2-32w	1988	12 Each		
D5020		Receptacle, 120 V, 15 Amp.	1988	16 Each		
D5020		Wiring Device, Switch	1988	5 Each		
D5030		Fire Alarm Bell, 6"	2000	2 Each		
D5030		Manual Pull Station	2000	1 Each		
G2040		Chain Link Fence Pedestrian Gate, 4' Wide	2000	2 Each		
G2040		Chain Link Fence, 8'	2000	130 Ln Ft		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Building Extended Component List with Remaining Service Life

Whitestone Research 23-Dec-14

Building: Storage Facility

Year Built: 1988

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1175

City: Hampton, VA

Replacement Value: \$223,719

per SF: \$65

Building Gsft: 3,448

Uniformat	Asset Description	Component	Date	Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
B2010		Steel, Painted, Exterior, 1st Floor	1988	49	4050 Sq Ft					
B2030		Steel, 10'x8', Painted, Overhead Coiling Door,	1988	9	1 Each					
B2030		Steel, Painted, Insulated, Exterior Door	1988	49	1 Each					
B3010		Aluminum Gutter, Downspouts, Fittings	1988	-6	0.45 K Ln Ft	\$2,745	\$0	\$2,745		
B3010		Metal Roof	1988	14	3500 Sq Ft					
C3020		Concrete Flooring	1988	49	3448 Sq Ft					
D3050	Bard Manufacturing M	Heat Pump, 3 Ton	1988	6	2 Each					4 Ton Through the wall type
D3060		Thermostat	1988	-16	2 Each	\$700	\$0	\$700		
D4010		Fire Alarm Control Panel	1988	-11	1 Each	\$3,041	\$0	\$3,041		
D4030		Fire Extinguisher	2010	8	2 Each					
D5010		Disconnect Switch, 30 Amp.	1988	24	4 Each					
D5010		Power Panel Board, 208 Y/120 V, 200 Amp.	1988	4	2 Each					
D5010		Secondary Transformer, Dry, 112-1/2 kVA	1988	4	1 Each					
D5020		Emergency Lighting Pack, 2 Light w/ Battery	2000	6	1 Each					
D5020		Exit Lighting Fixture, w/ Battery	2000	6	1 Each					
D5020		Fluorescent Lighting Fixture, T8, 2-32w	1988	-6	12 Each	\$1,994	\$0	\$1,994		
D5020		Receptacle, 120 V, 15 Amp.	1988	-6	16 Each	\$667	\$0	\$667		
D5020		Wiring Device, Switch	1988	-11	5 Each	\$169	\$0	\$169		
D5030		Fire Alarm Bell, 6"	2000	6	2 Each					
D5030		Manual Pull Station	2000	1	1 Each					
G2040		Chain Link Fence Pedestrian Gate, 4' Wide	2000	-4	2 Each	\$812	\$0	\$812		

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

All costs expressed in (\$) 2012.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

Forecast Year: 2013

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

Uniformat	Asset Description	Component	Date	Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
G2040		Chain Link Fence, 8'	2000	16	130 Ln Ft					

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Storage Facility

Facility: Langley Research Center

Building Num: 1175

City: Hampton, VA

Forecast Year: 2038 9 0 1 2 2043 4 5 6 7 2048 9 0 1 2 2053 4 5 6 7 2058 9 0 1 2

B20 Exterior Enclosure

Repair Steel, Painted, Exterior, 1st Floor (2% of Walls)	2,224																								
Finish Repaired Steel, Painted, Exterior, 1st Floor	96																								
Maintain Steel, 10'x8', Painted, Overhead Coiling Door, Motoriz	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Repair Steel, 10'x8', Painted, Overhead Coiling Door, Motoriz						637									637										
Refinish Steel, 10'x8', Painted, Overhead Coiling Door, Motoriz						147									147										
Replace Steel, 10'x8', Painted, Overhead Coiling Door, Motoriz																									
Finish Replaced Steel, 10'x8', Painted, Overhead Coiling Door																									
Maintain Steel, Painted, Insulated, Exterior Door Locks	21					21									21										
Replace Steel, Painted, Insulated, Exterior Door Locks	316														316										
Refinish Steel, Painted, Insulated, Exterior Door	26														26										
Repair Steel, Painted, Insulated, Exterior Door															177										
Refinish Steel, Painted, Exterior, 1st Floor	4,819														4,819										

B30 Roofing

Replace Aluminum Gutter, Downspouts, Fittings																								
Replace Metal Roof																								
Minor Replacement, Metal Roof (2% of Roof)																								
Maintain Metal Roof	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Maintain Aluminum Gutter, Downspouts, Fittings	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139
Repair Metal Roof	820					820									820									

C30 Interior Finishes

Repair Concrete Flooring (2% of Floors)																								

D30 HVAC

Maintain Heat Pump, 3 Ton	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155
Repair Heat Pump, 3 Ton																								
Replace Heat Pump, 3 Ton																								
Maintain Thermostat		38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Replace Thermostat	700														700									

D40 Fire Protection

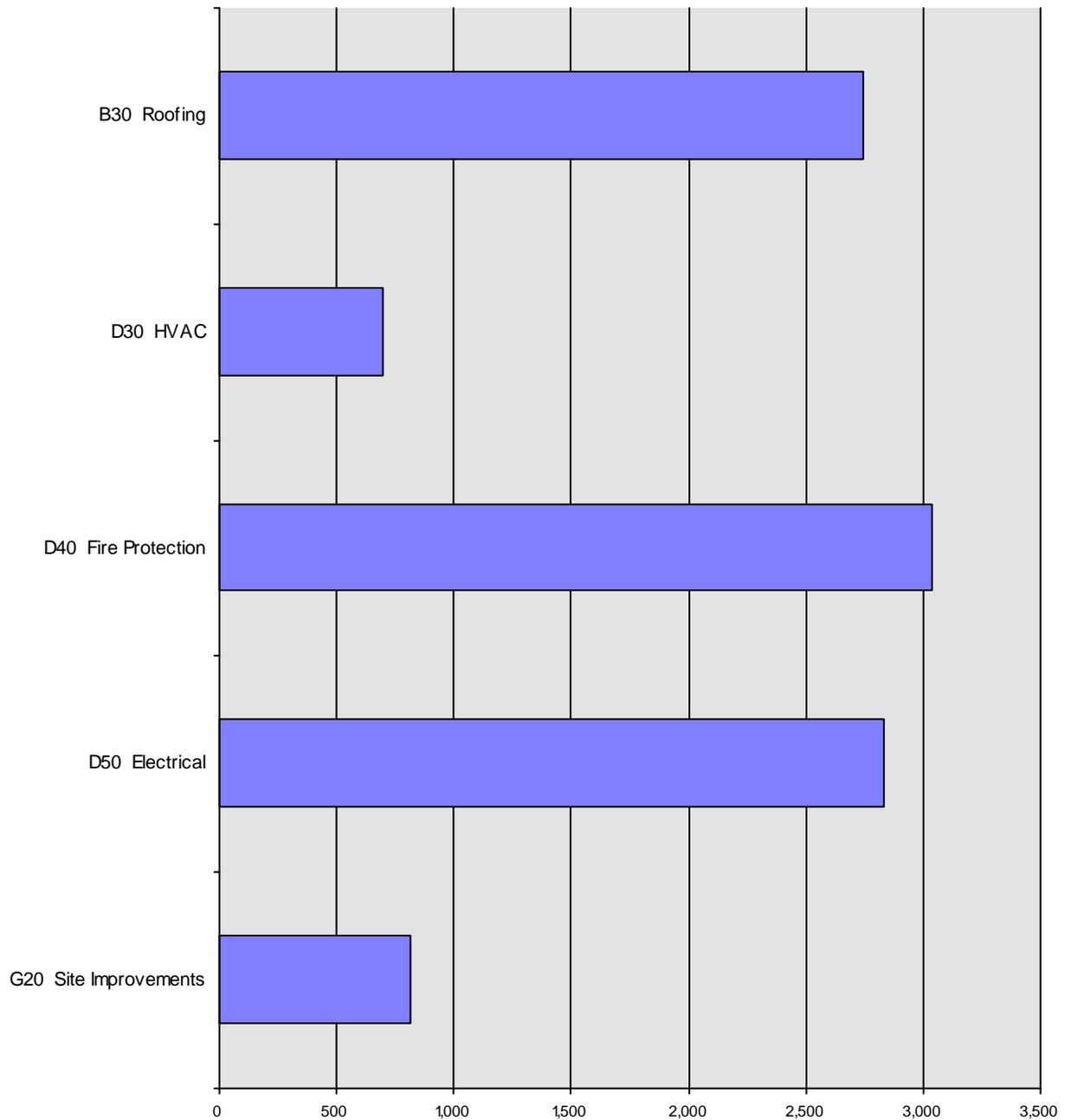
Inspect & Test Fire Extinguisher		63																						
Replace Fire Extinguisher																								
Inspect & Test Fire Alarm Control Panel	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
Repair Fire Alarm Control Panel	118					118									118									
Replace Fire Alarm Control Panel															3,041									

Building Deferred Maintenance by System Chart

Building: Storage Facility

Building Num: 1175

City: Hampton, VA



All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral and is included in Total Deferred Maintenance.

Based on a 50-Year Forecast.

23-Dec-14

Building Deferred Maintenance Detail

Whitestone Research

Building: Storage Facility

Year Built: 1988

Building Type: Temperature
Controlled
Warehouse

Facility: Langley Research Center

Original Cost: \$1

City: Hampton, VA

Replacement Value: \$223,719
per SF: \$65

Building Gsft: 3,448
Building Number: 1175

Year Installed	Years Deferred	Deferred Maintenance Task*	Deferred* Maintenance	Degradation Cost**	Total Deferred Maintenance
1988	10	Replace Fire Alarm Control Panel	\$3,041	\$0	\$3,041
1988	5	Replace Aluminum Gutter, Downspouts, Fittings	\$2,745	\$0	\$2,745
1988	5	Replace Fluorescent Lighting Fixture, T8, 2-32 w	\$1,994	\$0	\$1,994
2000	3	Replace Chain Link Fence Pedestrian Gate, 4' Wide	\$812	\$0	\$812
1988	15	Replace Thermostat	\$700	\$0	\$700
1988	5	Replace Receptacle, 120 V, 15 Amp.	\$667	\$0	\$667
1988	10	Replace Wiring Device, Switch	\$169	\$0	\$169
Total			\$10,128	\$0	\$10,128

All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

Based on a 50-Year Forecast.

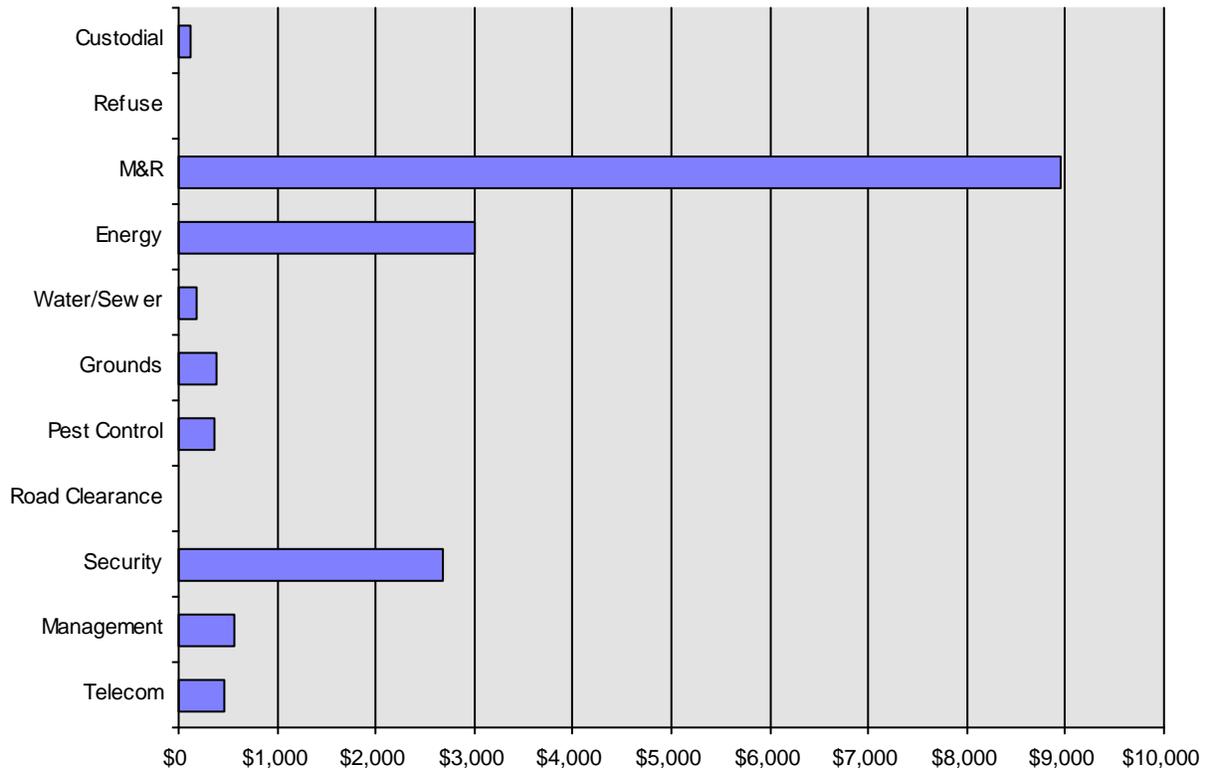
23-Dec-14

Operation Costs Summary

Whitestone Research

Building: Storage Facility **GSFT:** 3,448
Building Number: 1175 **Replacement Value:** \$223,719
Facility: Langley Research Center **Building Use:** Warehouse and Storage
City: Hampton, VA **Building Type:** Temperature Controlled Warehouse
Built Date: 1988

Operation	Annual Cost/GSFT	Annual Total	Percent
Custodial	\$0.034	\$119	0.7%
Energy	\$0.873	\$3,012	18.0%
Grounds	\$0.109	\$377	2.3%
M&R	\$2.595	\$8,947	53.4%
Management	\$0.162	\$559	3.3%
Pest Control	\$0.104	\$357	2.1%
Refuse	\$0.002	\$8	0.0%
Road Clearance	\$0.006	\$21	0.1%
Security	\$0.780	\$2,690	16.1%
Telecom	\$0.136	\$468	2.8%
Water/Sewer	\$0.054	\$187	1.1%
Building Total	\$4.86	\$16,745	100.0%



Building Operations Utility Details

Whitestone Research

Building: Storage Facility

Year Built: 1988

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1175

City: Hampton, VA

Replacement Value: \$223,719

per SF: \$65

Building Gsft: 3,448

		Utility	GSFT	Demand	UM	Rate	Cost
Operation:	Energy	Level of Service: Medium					
		Electricity	3448	10.791	kWh	\$0.0700	\$2,605
		Natural Gas	3448	0.158	Thm	\$0.7480	\$407
		Diesel	3448	0.000	Gal	\$3.1876	\$0
		Total:		10.949			\$3,012
Operation:	Refuse	Level of Service: Low					
		Municipal Solid Waste	3448	0.030	Lbs	\$0.0674	\$7
		Recycling	3448	0.010	Lbs	\$0.0348	\$1
		Total:		0.040			\$8
Operation:	Water/Sewer	Level of Service: Medium					
		Water	3448	7.280	Gal	\$0.0056	\$141
		Sewer	3448	5.720	Gal	\$0.0023	\$46
		Total:		13.000			\$187

Building Operations Task Details

Whitestone Research

Building: Storage Facility

Year Built: 1988

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1175

City: Hampton, VA

Replacement Value: \$223,719 **per SF:** \$65

Building Gsft: 3,448

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Custodial		Level of Service: Low			
Warehouse	3448	Sweep Hard Floor with 48" Push Broom	\$62	\$10	\$72
Warehouse	3448	Empty Trash; Wipe Clean & Re-line Basket	\$40	\$6	\$46
Total:			\$102	\$17	\$119
Operation: Grounds		Level of Service: Low			
Grounds, Improved	2068	Mow Turfgrass with 21" Power Mower	\$72	\$30	\$102
Grounds, Improved	2068	Aerate Improved Grounds	\$49	\$20	\$70
Grounds, Improved	2068	Clear Shrubs	\$41	\$17	\$58
Grounds, Improved	2068	Edge Clean & Trim Walks with Gas Powered Edger	\$30	\$12	\$43
Grounds, Improved	2068	Overseed, Improved Grounds	\$25	\$10	\$35
Grounds, Improved	2068	Vacuum with 30" Billy Goat	\$16	\$7	\$23
Grounds, Improved	2068	Clear Crabgrass	\$12	\$5	\$17
Grounds, Improved	2068	Clear Weeds with 15" Boom, Improved Grounds	\$7	\$3	\$9
Grounds, Improved	2068	Trim Around Raised Objects with String Edger	\$6	\$3	\$9
Grounds, Improved	2068	Fertilize Improved Grounds	\$5	\$2	\$7
Grounds, Improved	2068	Sweep with 30" Power Rake	\$3	\$1	\$5
Grounds, Improved	2068	Fertilize Using Power Take Off Broadcast	\$0	\$0	\$0
Total:			\$267	\$111	\$377
Operation: Pest Control		Level of Service: Medium			
Pest Controlled	3448	Install, or Check and Re-Bait 5 Rodent Boxes	\$123	\$51	\$174
Pest Controlled	3448	Perform Crawling Insect Abatement	\$93	\$38	\$131
Pest Controlled	3448	Inspect Building for Pests	\$51	\$0	\$51
Total:			\$267	\$90	\$357
Operation: Road Clearance		Level of Service: Medium			
Pavement NASA	2758	Plow Paved Area	\$16	\$5	\$21
Total:			\$16	\$5	\$21

All costs expressed in (\$) 2012.

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Security		Level of Service: Low			
Secured Area	3448	Patrol Building Perimeter	\$0	\$0	\$0
Secured Area	3448	Guard Lobby/Parking	\$0	\$0	\$0
Total:			\$0	\$0	\$0

Building Operations Service Details

Whitestone Research

Building: Storage Facility

Year Built: 1988

FTEs: 1

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1175

City: Hampton, VA

Replacement Value: \$223,719

per SF: \$65

Building Gsft: 3,448

		Service*	Quantity	Rate	Cost
Operation:	Security	Level of Service: Low			
		Access Control	1	\$2,690	\$2,690
		Total:			\$2,690
Operation:	Telecom	Level of Service: Low			
		Local Telephone	1	\$468	\$468
		Total:			\$468

Building Operations Management Details

Whitestone Research

Building: Storage Facility

Year Built: 1988

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1175

City: Hampton, VA

Replacement Value: \$223,719

per SF: \$65

Building Gsft: 3,448

	Service	Demand	UM	PRV	Cost
Operation: Management	Level of Service: Low				
	Management	0.3%	PRV	\$223,719	\$559
	Total:				\$559

Attachment C: Detailed MARS Reports for LaRC Property ID 212

Average M&R Costs

Whitestone Research

Building:	Storage Facility	GSFT:	6,246
Building Number:	1240	PRV:	\$367,378
Facility:	Langley Research Center	Built Date:	1951
City:	Hampton, VA		

M&R Average Annual Cost Forecasts

	Current Year	5 Year	20 Year	50 Year
PM & Minor Repair:	\$1,417	\$1,379	\$1,423	\$1,435
Unscheduled Maintenance:	\$1,298	\$1,245	\$1,280	\$1,299
Renewal & Replacement:	\$3,215	\$5,070	\$13,083	\$7,570
Total M&R Costs:	\$5,930	\$7,694	\$15,786	\$10,304
Per GSFT:	\$0.95	\$1.23	\$2.53	\$1.65
As % of PRV:	1.61%	2.09%	4.30%	2.80%

Building Component List

Whitestone Research

Building: Storage Facility

Year Built: 1951

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1240

City: Hampton, VA

Replacement Value: \$367,378 **per SF:** \$59

Building Gsft: 6,246

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B2010		Steel, Painted, Exterior, 1st Floor	1951	3900 Sq Ft		
B2020		Aluminum Fixed Window, 12 sf, 1st Floor	1990	14 Each		
B2030		Steel w/ Safety Glass, Painted, Exterior Door	1951	2 Each		
B2030		Steel, 14'x10', Painted, Overhead Coiling Door, Motorized	1980	2 Each		
B3010		Aluminum Gutter, Downspouts, Fittings	1951	0.5 K Ln Ft		
B3010		Metal Roof	1951	3600 Sq Ft		
C1020		Steel, Painted, Interior Door	1951	3 Each		
C3010		Gypsum Board, Interior Wall Finish	1951	700 Sq Ft		
C3010		Wood, Finished, Interior Paneling	1951	600 Sq Ft		
C3020		Carpet, Nylon 20 oz., High Traffic	2005	450 Sq Ft		
C3020		Concrete Flooring	1951	3050 Sq Ft		
D3040		Exhaust Fan, Propeller, 375 Cfm	1951	1 Each		
D3050		Air Conditioner, Window, 1 Ton	1951	4 Each		
D3050		Baseboard Heating Units	1951	7 Each		
D4030		Fire Extinguisher	2010	4 Each		
D5010		Disconnect Switch, 30 Amp.	1951	4 Each		
D5010		Power Panel Board, 208 Y/120 V, 400 Amp.	1951	1 Each		
D5020		Fluorescent Lighting Fixture, T8, 2-32w	1951	12 Each		
D5020		Fluorescent Lighting Fixture, T8, 4-32 w	1951	36 Each		
D5020		Metal Halide Lighting Fixture, Wall Mount, 150 w	2000	2 Each		
D5020		Receptacle, 120 V, 15 Amp.	1951	30 Each		
D5020		Wiring Device, Switch	1951	10 Each		
D5030		Public Address Speaker	1951	3 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

23-Dec-14

Building Extended Component List with Remaining Service Life

Whitestone Research 23-Dec-14

Building: Storage Facility

Year Built: 1951

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1240

City: Hampton, VA

Replacement Value: \$367,378

per SF: \$59

Building Gsft: 6,246

Uniformat	Asset Description	Component	Date	Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
B2010		Steel, Painted, Exterior, 1st Floor	1951	12	3900 Sq Ft					
B2020		Aluminum Fixed Window, 12 sf, 1st Floor	1990	51	14 Each					
B2030		Steel w/ Safety Glass, Painted, Exterior Door	1951	12	2 Each					
B2030		Steel, 14'x10', Painted, Overhead Coiling Door	1980	1	2 Each					
B3010		Aluminum Gutter, Downspouts, Fittings	1951	-43	0.5 K Ln Ft	\$3,050	\$0	\$3,050		
B3010		Metal Roof	1951	-23	3600 Sq Ft	\$37,343	\$0	\$37,343		
C1020		Steel, Painted, Interior Door	1951	12	3 Each					
C3010		Gypsum Board, Interior Wall Finish	1951	12	700 Sq Ft					
C3010		Wood, Finished, Interior Paneling	1951	12	600 Sq Ft					
C3020		Carpet, Nylon 20 oz., High Traffic	2005	-1	450 Sq Ft					
C3020		Concrete Flooring	1951	12	3050 Sq Ft					
D3040		Exhaust Fan, Propeller, 375 Cfm	1951	-44	1 Each	\$614	\$0	\$614		
D3050		Air Conditioner, Window, 1 Ton	1951	-31	4 Each	\$5,666	\$0	\$5,666		
D3050		Baseboard Heating Units	1951	-43	7 Each	\$1,804	\$0	\$1,804		
D4030		Fire Extinguisher	2010	8	4 Each					
D5010		Disconnect Switch, 30 Amp.	1951	-13	4 Each	\$1,334	\$0	\$1,334		
D5010		Power Panel Board, 208 Y/120 V, 400 Amp.	1951	-33	1 Each	\$7,107	\$0	\$7,107		
D5020		Fluorescent Lighting Fixture, T8, 2-32w	1951	-43	12 Each	\$1,994	\$0	\$1,994		
D5020		Fluorescent Lighting Fixture, T8, 4-32 w	1951	-43	36 Each	\$5,981	\$0	\$5,981		
D5020		Metal Halide Lighting Fixture, Wall Mount, 150	2000	6	2 Each					
D5020		Receptacle, 120 V, 15 Amp.	1951	-43	30 Each	\$1,251	\$0	\$1,251		

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

All costs expressed in (\$) 2012.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

Forecast Year: 2013

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

Uniformat	Asset Description	Component	Date	Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
D5020		Wiring Device, Switch	1951	-48	10 Each	\$339	\$0	\$339		
D5030		Public Address Speaker	1951	-48	3 Each	\$828	\$0	\$828		

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Storage Facility

Facility: Langley Research Center

Building Num: 1240

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Finish Repaired Gypsum Board, Interior Wall Finish																									
Replace Gypsum Board, Interior Wall Finish														1,488											
Finish Replaced Gypsum Board, Interior Wall Finish														681											
Finish Repaired Wood, Finished, Interior Paneling									13															13	
Replace Wood, Finished, Interior Paneling														9,437											
Finished Replaced Wood, Finished, Interior Paneling														644											
Repair Carpet, Nylon 20 oz., High Traffic (2% of Carpet)			64		64		64				64		64		64				64		64		64		
Replace Carpet, Nylon 20 oz., High Traffic	3,215								3,215									3,215							3,215
Repair Concrete Flooring (2% of Floors)																									
Replace Concrete Flooring														22,115											
Refinish Wood, Finished, Interior Paneling									644															644	

D30 HVAC

Repair Air Conditioner, Window, 1 Ton																									402
Repair Baseboard Heating Units																									
Replace Air Conditioner, Window, 1 Ton			5,666																						
Maintain Air Conditioner, Window, 1 Ton	422	422		422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422
Replace Exhaust Fan, Propeller, 375 Cfm														614											
Repair Exhaust Fan, Propeller, 375 Cfm					188																				
Maintain Exhaust Fan, Propeller, 375 Cfm	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
Replace Baseboard Heating Units, 5' Long																									1,804

D40 Fire Protection

Replace Fire Extinguisher											1,180														1,180
Inspect & Test Fire Extinguisher			127						127						127						127				

D50 Electrical

Replace Fluorescent Lighting Fixture, T8, 4-32 w																									5,981
Maintain Public Address Speaker	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Replace Wiring Device, Switch														339											
Repair Wiring Device, Switch									328																328
Replace Receptacle, 120 V, 15 Amp.																									1,251
Replace Metal Halide Lighting Fixture, Wall Mount, 150 w									1,041																
Replace Ballast, Metal Halide Lighting Fixture, Wall Mount, 150																									401
Replace Lamp, Metal Halide Lighting Fixture, Wall Mount, 150			192										192						192						192
Replace Fluorescent Lighting Fixture, T8, 2-32 w																									1,994
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 4-3											3,751														
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 2-3											1,250														
Replace Power Panel Board, 208 Y/120 V, 400 Amp.																									

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Storage Facility

Facility: Langley Research Center

Building Num: 1240

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Finish Repaired Gypsum Board, Interior Wall Finish									14																
Replace Gypsum Board, Interior Wall Finish																									
Finish Replaced Gypsum Board, Interior Wall Finish																									
Finish Repaired Wood, Finished, Interior Paneling									13										13						
Replace Wood, Finished, Interior Paneling																									
Finished Replaced Wood, Finished, Interior Paneling																									
Repair Carpet, Nylon 20 oz., High Traffic (2% of Carpet)		64		64		64					64		64		64			64		64		64			
Replace Carpet, Nylon 20 oz., High Traffic								3,215								3,215								3,215	
Repair Concrete Flooring (2% of Floors)				442															442						
Replace Concrete Flooring																									
Refinish Wood, Finished, Interior Paneling									644										644						

D30 HVAC

Repair Air Conditioner, Window, 1 Ton																									
Repair Baseboard Heating Units																									
Replace Air Conditioner, Window, 1 Ton									5,666																
Maintain Air Conditioner, Window, 1 Ton	422	422	422	422	422	422	422	422	422		422	422	422	422	422	422	422	422	422	422	422	422	422	422	422
Replace Exhaust Fan, Propeller, 375 Cfm									614																
Repair Exhaust Fan, Propeller, 375 Cfm	188																			188					
Maintain Exhaust Fan, Propeller, 375 Cfm	91	91	91	91	91	91	91	91		91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
Replace Baseboard Heating Units, 5' Long																1,804									

D40 Fire Protection

Replace Fire Extinguisher									1,180												1,180				
Inspect & Test Fire Extinguisher		127					127						127							127					

D50 Electrical

Replace Fluorescent Lighting Fixture, T8, 4-32 w																5,981									
Maintain Public Address Speaker	60	60	60		60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Replace Wiring Device, Switch				339																339					
Repair Wiring Device, Switch																328									
Replace Receptacle, 120 V, 15 Amp.																1,251									
Replace Metal Halide Lighting Fixture, Wall Mount, 150 w			1,041																				1,041		
Replace Ballast, Metal Halide Lighting Fixture, Wall Mount, 15																401									
Replace Lamp, Metal Halide Lighting Fixture, Wall Mount, 150								192								192			192						
Replace Fluorescent Lighting Fixture, T8, 2-32 w																1,994									
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 4-				3,751																			3,751		
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 2-				1,250																			1,250		
Replace Power Panel Board, 208 Y/120 V, 400 Amp.				7,107																					

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Storage Facility

Facility: Langley Research Center

Building Num: 1240

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Repair Power Panel Board, 208 Y/120 V, 400 Amp.									96										96							
Maintain Power Panel Board, 208 Y/120 V, 400 Amp.	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Replace Disconnect Switch, 30 Amp.																										
Maintain Disconnect Switch, 30 Amp.	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
Replace Public Address Speaker														828												
Repair Disconnect Switch, 30 Amp.									501										501							

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Storage Facility

Facility: Langley Research Center

Building Num: 1240

City: Hampton, VA

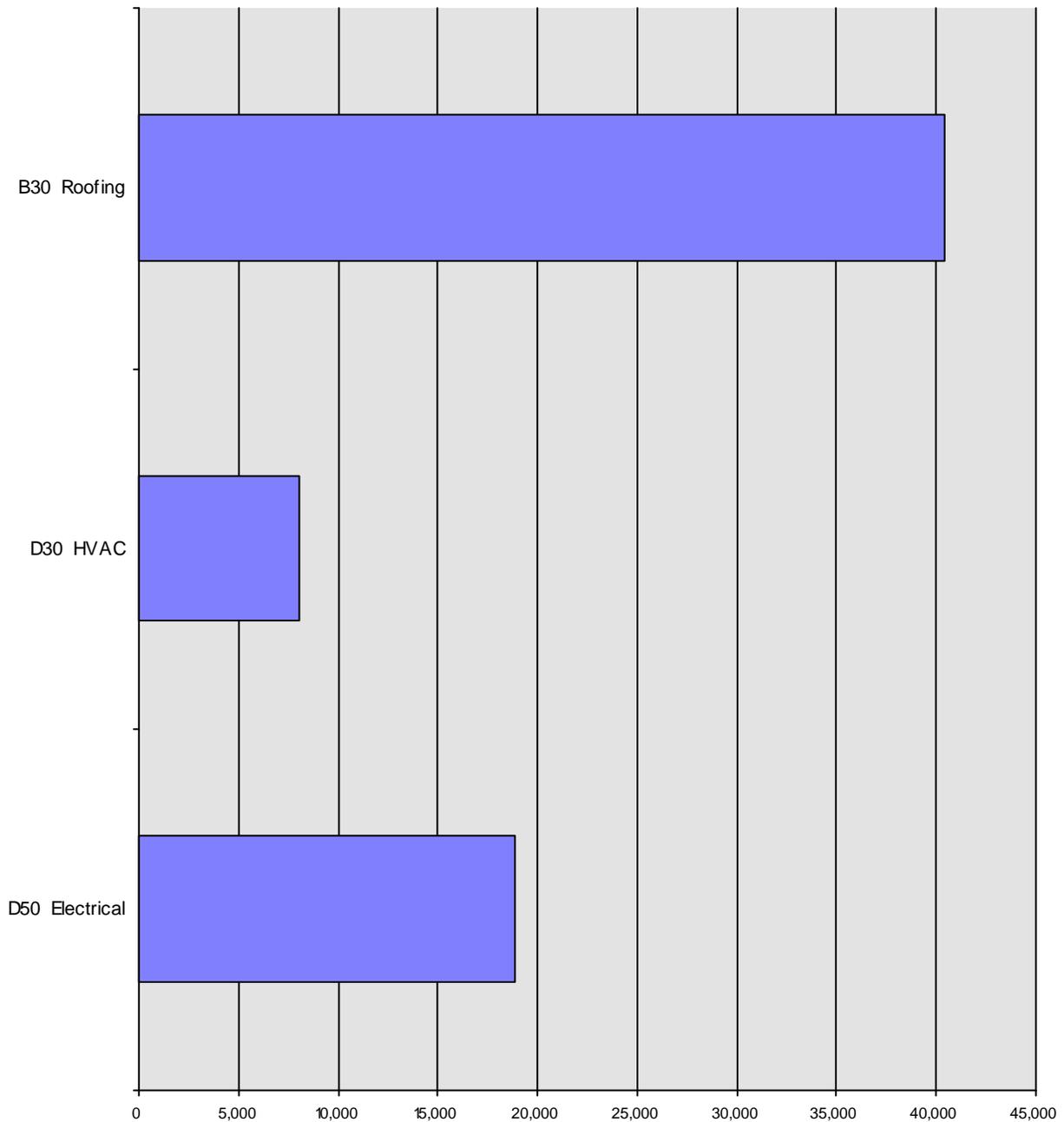
Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2		
Repair Power Panel Board, 208 Y/120 V, 400 Amp.																										96	
Maintain Power Panel Board, 208 Y/120 V, 400 Amp.	60	60	60			60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Replace Disconnect Switch, 30 Amp.																											1,334
Maintain Disconnect Switch, 30 Amp.	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
Replace Public Address Speaker						828																					828
Repair Disconnect Switch, 30 Amp.						501																					501

Building Deferred Maintenance by System Chart

Building: Storage Facility

Building Num: 1240

City: Hampton, VA



All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral and is included in Total Deferred Maintenance.

Based on a 50-Year Forecast.

23-Dec-14

Building Deferred Maintenance Detail

Whitestone Research

Building: Storage Facility

Year Built: 1951

Building Type: Non-Temperature Controlled

Facility: Langley Research Center

Original Cost: \$1

City: Hampton, VA

Replacement Value: \$367,378
per SF: \$59

Building Gsft: 6,246
Building Number: 1240

Year Installed	Years Deferred	Deferred Maintenance Task*	Deferred* Maintenance	Degradation Cost**	Total Deferred Maintenance
1951	22	Replace Metal Roof	\$37,343	\$0	\$37,343
1951	32	Replace Power Panel Board, 208 Y/120 V, 400 Amp.	\$7,107	\$0	\$7,107
1951	42	Replace Fluorescent Lighting Fixture, T8, 4-32 w	\$5,981	\$0	\$5,981
1951	30	Replace Air Conditioner, Window, 1 Ton	\$5,666	\$0	\$5,666
1951	42	Replace Aluminum Gutter, Downspouts, Fittings	\$3,050	\$0	\$3,050
1951	42	Replace Fluorescent Lighting Fixture, T8, 2-32 w	\$1,994	\$0	\$1,994
1951	42	Replace Baseboard Heating Units, 5' Long	\$1,804	\$0	\$1,804
1951	12	Replace Disconnect Switch, 30 Amp.	\$1,334	\$0	\$1,334
1951	42	Replace Receptacle, 120 V, 15 Amp.	\$1,251	\$0	\$1,251
1951	47	Replace Public Address Speaker	\$828	\$0	\$828
1951	43	Replace Exhaust Fan, Propeller, 375 Cfm	\$614	\$0	\$614
1951	47	Replace Wiring Device, Switch	\$339	\$0	\$339
Total			\$67,311	\$0	\$67,311

All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

Based on a 50-Year Forecast.

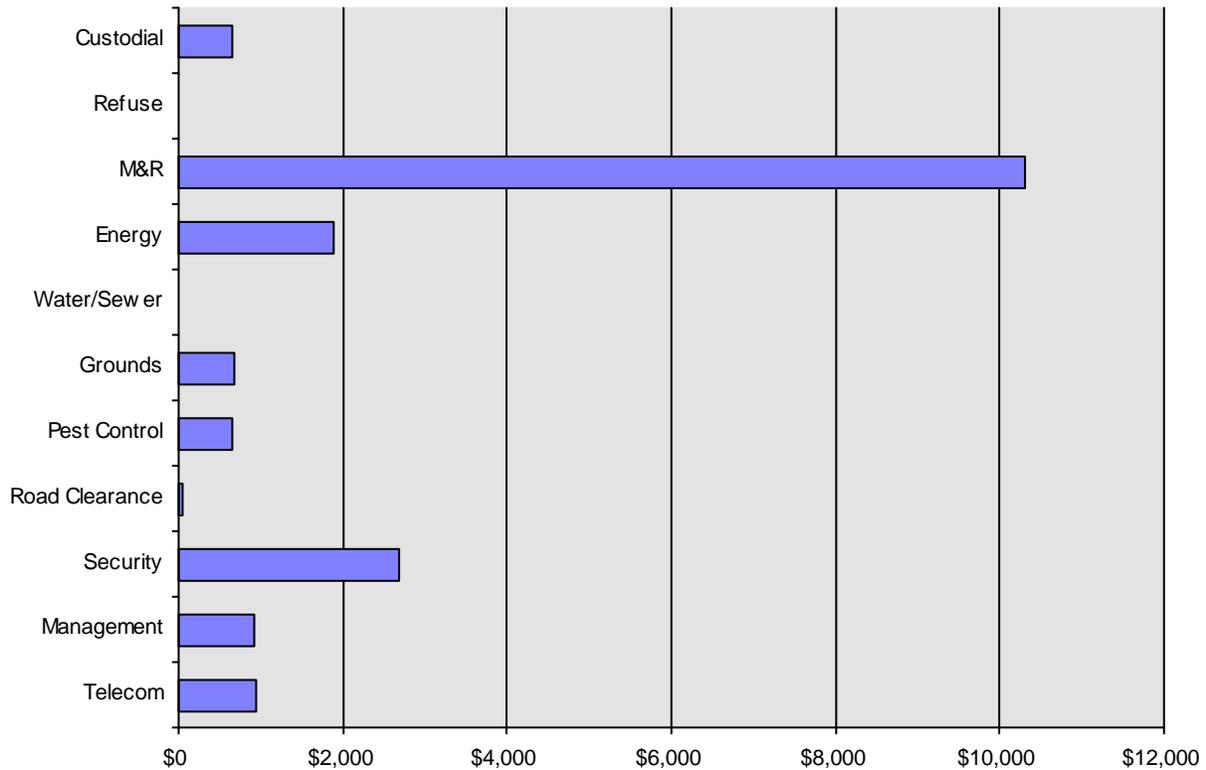
23-Dec-14

Operation Costs Summary

Whitestone Research

Building: Storage Facility **GSFT:** 6,246
Building Number: 1240 **Replacement Value:** \$367,378
Facility: Langley Research Center **Building Use:** Warehouse and Storage
City: Hampton, VA **Building Type:** Non-Temperature
Controlled Warehouse
Built Date: 1951

Operation	Annual Cost/GSFT	Annual Total	Percent
Custodial	\$0.103	\$642	3.4%
Energy	\$0.301	\$1,879	10.0%
Grounds	\$0.109	\$684	3.6%
M&R	\$1.650	\$10,305	54.9%
Management	\$0.147	\$918	4.9%
Pest Control	\$0.104	\$647	3.4%
Refuse	\$0.002	\$15	0.1%
Road Clearance	\$0.006	\$38	0.2%
Security	\$0.431	\$2,690	14.3%
Telecom	\$0.150	\$936	5.0%
Water/Sewer	\$0.004	\$26	0.1%
Building Total	\$3.01	\$18,780	100.0%



Building Operations Utility Details

Whitestone Research

Building: Storage Facility

Year Built: 1951

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1240

City: Hampton, VA

Replacement Value: \$367,378

per SF: \$59

Building Gsft: 6,246

	Utility	GSFT	Demand	UM	Rate	Cost
Operation: Energy	Level of Service: Low					
	Electricity	6246	3.717	kWh	\$0.0700	\$1,625
	Natural Gas	6246	0.054	Thm	\$0.7480	\$254
	Diesel	6246	0.000	Gal	\$3.1876	\$0
	Total:		3.771			\$1,879
Operation: Refuse	Level of Service: Low					
	Municipal Solid Waste	6246	0.030	Lbs	\$0.0674	\$13
	Recycling	6246	0.010	Lbs	\$0.0348	\$2
	Total:		0.040			\$15
Operation: Water/Sewer	Level of Service: Low					
	Water	6246	0.560	Gal	\$0.0056	\$20
	Sewer	6246	0.440	Gal	\$0.0023	\$6
	Total:		1.000			\$26

Building Operations Task Details

Whitestone Research

Building: Storage Facility

Year Built: 1951

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1240

City: Hampton, VA

Replacement Value: \$367,378 **per SF:** \$59

Building Gsft: 6,246

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Custodial		Level of Service: Low			
Warehouse	5621	Sweep Hard Floor with 48" Push Broom	\$101	\$16	\$118
Warehouse	5621	Empty Trash; Wipe Clean & Re-line Basket	\$65	\$11	\$75
Office	624	Vacuum Carpet with 14" Upright Vacuum	\$219	\$36	\$254
Office	624	Empty Trash; Wipe Clean & Re-line Basket	\$62	\$10	\$73
Office	624	Clean and Wipe Furniture with Trigger Sprayer & Cloth	\$38	\$6	\$45
Office	624	Dust Surfaces with Duster	\$29	\$5	\$34
Office	624	Vacuum Upholstered Furniture with Tank or Canister Vacuum	\$24	\$4	\$28
Office	624	Dust Window Blinds	\$14	\$2	\$16
Total:			\$552	\$90	\$642
Operation: Grounds		Level of Service: Low			
Grounds, Improved	3747	Mow Turfgrass with 21" Power Mower	\$131	\$55	\$186
Grounds, Improved	3747	Aerate Improved Grounds	\$89	\$37	\$126
Grounds, Improved	3747	Clear Shrubs	\$74	\$31	\$105
Grounds, Improved	3747	Edge Clean & Trim Walks with Gas Powered Edger	\$54	\$23	\$77
Grounds, Improved	3747	Overseed, Improved Grounds	\$44	\$19	\$63
Grounds, Improved	3747	Vacuum with 30" Billy Goat	\$30	\$12	\$42
Grounds, Improved	3747	Clear Crabgrass	\$22	\$9	\$32
Grounds, Improved	3747	Clear Weeds with 15" Boom, Improved Grounds	\$12	\$5	\$17
Grounds, Improved	3747	Trim Around Raised Objects with String Edger	\$11	\$5	\$16
Grounds, Improved	3747	Fertilize Improved Grounds	\$9	\$4	\$13
Grounds, Improved	3747	Sweep with 30" Power Rake	\$6	\$2	\$8
Grounds, Improved	3747	Fertilize Using Power Take Off Broadcast	\$0	\$0	\$0
Total:			\$483	\$201	\$684
Operation: Pest Control		Level of Service: Medium			
Pest Controlled	6246	Install, or Check and Re-Bait 5 Rodent Boxes	\$223	\$93	\$316
Pest Controlled	6246	Perform Crawling Insect Abatement	\$168	\$70	\$237

All costs expressed in (\$) 2012.

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Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Pest Controlled	6246	Inspect Building for Pests	\$93	\$0	\$93
Total:			\$484	\$163	\$647
Operation: Road Clearance		Level of Service: Medium			
Pavement NASA	4996	Plow Paved Area	\$29	\$9	\$38
Total:			\$29	\$9	\$38
Operation: Security		Level of Service: Low			
Secured Area	6246	Patrol Building Perimeter	\$0	\$0	\$0
Secured Area	6246	Guard Lobby/Parking	\$0	\$0	\$0
Total:			\$0	\$0	\$0

Building Operations Service Details

Whitestone Research

Building: Storage Facility

Year Built: 1951

FTEs: 2

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1240

City: Hampton, VA

Replacement Value: \$367,378

per SF: \$59

Building Gsft: 6,246

	Service*		Quantity	Rate	Cost
Operation:	Security	Level of Service: Low			
		Access Control	1	\$2,690	\$2,690
		Total:			\$2,690
Operation:	Telecom	Level of Service: Low			
		Local Telephone	2	\$468	\$936
		Total:			\$936

Building Operations Management Details

Whitestone Research

Building: Storage Facility

Year Built: 1951

Building Type: Non-Temperature Control

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1240

City: Hampton, VA

Replacement Value: \$367,378

per SF: \$59

Building Gsft: 6,246

		Service	Demand	UM	PRV	Cost
Operation:	Management	Level of Service: Low				
		Management	0.3%	PRV	\$367,378	\$918
		Total:				\$918

Attachment D: Detailed MARS Reports for LaRC Property ID 153

Average M&R Costs

Whitestone Research

	Distribution Center	GSFT: 35,625
Building Number:	1206	PRV: \$3,639,735
Facility:	Langley Research Center	Built Date: 1966
City:	Hampton, VA	

M&R Average Annual Cost Forecasts

	Current Year	5 Year	20 Year	50 Year
PM & Minor Repair:	\$25,685	\$26,333	\$26,112	\$26,143
Unscheduled Maintenance:	\$19,534	\$20,043	\$19,389	\$19,471
Renewal & Replacement:	\$485	\$67,417	\$84,316	\$105,440
Total M&R Costs:	\$45,704	\$113,793	\$129,817	\$151,054
Per GSFT:	\$1.28	\$3.19	\$3.64	\$4.24
As % of PRV:	1.26%	3.13%	3.57%	4.15%

Building Component List

Whitestone Research

Building: Distribution Center

Year Built: 1966

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1206

City: Hampton, VA

Replacement Value: \$3,639,735 **per SF:** \$102

Building Gsft: 35,625

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B1010		Concrete Decking	1966	1223 Sq Ft		
B1010		Concrete Ramp	1966	399 Sq Ft		
B2010		Steel, Insulated Wall Panels, Painted, Exterior, 2"	1966	11810 Sq Ft		
B2020		Steel Operable Window, 12 sf, 1st Fl	1966	19 Each		
B2030		Steel, 14'x10', Painted, Overhead Coiling Door, Motorized	1990	5 Each		
B2030		Steel, Painted, Exterior Door	1966	7 Each		
B2030		Steel, Painted, Exterior Double Door	1966	2 Each		
B3010		Aluminum Gutter, Downspouts, Fittings	1966	0.8 K Ln Ft		
B3010		Metal Canopy	1966	1733 Sq Ft		
B3010		Metal Roof	1966	36800 Sq Ft		sprayed with foam
C1010		Plexiglass Fixed Window, UV Filtering, 24 Sf	1966	5 Each		
C1010		Toilet Partitions, Painted Metal, Overhead Braced	1966	4 Each		
C1020		Steel, 10'x8', Painted, Overhead Coiling Door, Motorized	1990	2 Each		
C1020		Steel, Painted, Interior Double Door w/ Safety Glass	1966	1 Each		
C1020		Wood, Hollow Core, Painted, Interior Door	1966	19 Each		
C2010		Concrete, Exterior Stairs	1966	131 Sq Ft		
C2010		Concrete, Interior Stairs	1966	39 Sq Ft	120	
C2010		Metal, Painted, Exterior Railing	1966	107 Ln Ft		
C2010		Metal, Painted, Exterior Stairs	1966	31 Sq Ft		
C2010		Metal, Painted, Interior Railing	1966	70 Ln Ft		
C2010		Metal, Painted, Interior Stairs	1966	198 Sq Ft		
C3010		Ceramic Tile, 4"x4", Interior Wall Finish	1966	250 Sq Ft	104,107	
C3010		Ceramic Tile, 4"x4", Interior Wall Finish	1966	777 Sq Ft	109,112	
C3010		Concrete Block, Interior Wall Finish	1966	3829 Sq Ft	101	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	812 Sq Ft	110	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	250 Sq Ft	104,107	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	726 Sq Ft	105	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	776 Sq Ft	109,112	

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

23-Dec-14

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
C3010		Concrete Block, Painted, Interior Wall Finish	1966	944 Sq Ft	114	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	1730 Sq Ft	116	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	179 Sq Ft	108E	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	158 Sq Ft	108D	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	7644 Sq Ft	108	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	670 Sq Ft	119	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	2257 Sq Ft	120	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	599 Sq Ft	122,121,123	
C3010		Gypsum Board, Interior Wall Finish	1966	2351 Sq Ft	122,121,123	
C3010		Gypsum Board, Interior Wall Finish	1966	7698 Sq Ft	124,125,126,127,128,129,130,131,H	
C3010		Gypsum Board, Interior Wall Finish	1966	1636 Sq Ft	119	
C3010		Gypsum Board, Interior Wall Finish	1966	1334 Sq Ft	120	
C3010		Gypsum Board, Interior Wall Finish	1966	438 Sq Ft	108D	
C3010		Gypsum Board, Interior Wall Finish	1966	734 Sq Ft	108A	
C3010		Gypsum Board, Interior Wall Finish	1966	425 Sq Ft	108	
C3010		Gypsum Board, Interior Wall Finish	1966	334 Sq Ft	116	
C3010		Gypsum Board, Interior Wall Finish	1966	965 Sq Ft	108B	
C3010		Gypsum Board, Interior Wall Finish	1966	445 Sq Ft	108E	
C3010		Gypsum Board, Interior Wall Finish	1966	1192 Sq Ft	102,103,103A	
C3010		Steel, Painted, Interior Wall Finish	1966	935 Sq Ft		
C3020		Carpet, Nylon 20 oz., High Traffic	1966	961 Sq Ft	121,122,123	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	1036 Sq Ft	108B,116	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	148 Sq Ft	108A	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	779 Sq Ft	119	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	1792 Sq Ft	125,126,127,H1A,129,128,124,130,1	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	1080 Sq Ft	102,103,103A	
C3020		Ceramic Tile Flooring	1966	314 Sq Ft	109,112	
C3020		Ceramic Tile Flooring	1966	49 Sq Ft	107	
C3020		Ceramic Tile Flooring	1966	151 Sq Ft	104	
C3020		Concrete Flooring	1966	7412 Sq Ft	101, above 102,103,103A	
C3020		Concrete Flooring	1966	145 Sq Ft		
C3020		Concrete Flooring	1966	14726 Sq Ft	108,108D,108E,110	
C3020		Concrete Flooring	1966	2141 Sq Ft	120	
C3020		Concrete Flooring	1966	230 Sq Ft	114	
C3020		Metal Floor Grating	1966	4662 Sq Ft	108 2nd floor	
C3030		Acoustical Tile Ceiling	1966	1768 Sq Ft	125,126,127,H1A,129,128,124,130,1	

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

23-Dec-14

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
C3030		Acoustical Tile Ceiling	1966	310 Sq Ft	109,112	
C3030		Acoustical Tile Ceiling	1966	149 Sq Ft	104	
C3030		Acoustical Tile Ceiling	1966	48 Sq Ft	107	
C3030		Acoustical Tile Ceiling	1966	948 Sq Ft	121,122,123	
C3030		Acoustical Tile Ceiling	1966	1066 Sq Ft	102,103,103A	
C3030		Gypsum Board, Finished Ceiling	1966	768 Sq Ft	119	
C3030		Gypsum Board, Finished Ceiling	1966	1022 Sq Ft	108B,116	
C3030		Metal Ceiling	1966	14527 Sq Ft	108,108D,108E,110	
C3030		Metal Ceiling	1966	2112 Sq Ft	120	
C3030		Metal Ceiling	1966	5797 Sq Ft	101	
C3030		Metal Ceiling	1966	227 Sq Ft	114	
C3030		Metal Ceiling	1966	143 Sq Ft		
C3030		Plywood Ceiling, Painted	1966	146 Sq Ft		
D1090		Dock Ramp Leveler	1966	4 Each		
D2010		Emergency Eye Wash	1966	1 Each		
D2010		Lavatory, Vitreous China	1966	5 Each		
D2010		Service Sink, Iron, Enamel	1966	1 Each		
D2010		Sink, Stainless Steel	1966	1 Each		
D2010		Tankless Water Closet	1966	6 Each		
D2010		Urinal, Vitreous China	1966	4 Each		
D2010		Water Cooler, Electric	1995	4 Each		
D2020		Hose Bib	1966	1 Each		
D2020		Pipe & Fittings, 3/4" Copper, Cold Water	1966	0.35 K Ln Ft		
D2020		Pipe & Fittings, 3/4" Copper, Hot Water	1966	0.35 K Ln Ft		
D2020		Pipe Insulation, Fiberglass, Cold Water	1966	0.35 K Ln Ft		
D2020		Pipe Insulation, Fiberglass, Hot Water	1966	0.35 K Ln Ft		
D2020	Bradford-White MI20U5	Water Heater, Electric, 15 Gal.	1966	1 Each		
D2020		Water Heater, Electric, 5 Gal.	1966	1 Each		6 Gal
D2030		Backflow Preventer, 2"	2000	2 Each		
D2030		Backflow Preventer, 3/4"	2000	1 Each		
D2030		Floor Drain	1966	1 Each		
D2030		Pipe & Fittings, 2" PVC	1990	0.05 K Ln Ft		
D2030		Pipe & Fittings, 3" Cast Iron	1966	0.3 K Ln Ft		
D2030		Pipe & Fittings, 4" Cast Iron	1966	0.1 K Ln Ft		
D3010		Pressure Reducer Valve, 2"	1966	2 Each		
D3020		Boiler, Gas, 100 Mbh	2000	1 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

23-Dec-14

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D3020		Condensate Removal Pump System, 1/50 HP	2006	1 Each		
D3020		Gate Valve, 6"	1966	2 Each		
D3020		Heat Exchanger, Steam-to-Water, 15 Gpm	2006	1 Each		
D3020		Pipe & Fittings, 10" Steel	1966	0.05 K Ln Ft		
D3020		Pipe & Fittings, 2" Steel	1966	0.35 K Ln Ft		
D3020		Pipe & Fittings, 4" Steel	1966	0.1 K Ln Ft		
D3020		Pipe Insulation, Fiberglass, Heating Water/Steam	1966	0.35 K Ln Ft		
D3020		Steam Trap, F&T, 2"	1966	40 Each		
D3020		Valve, Non-Drain, 10"	1966	2 Each		Steam Valve
D3030		Ball Valve, 1"	1966	6 Each		Relief Valve
D3030		Condenser, Air-Cooled, 1 Ton	1994	8 Each		
D3030		Condenser, Air-Cooled, 10 Ton	2006	1 Each		
D3030		Expansion Tank, 30 Gal.	1966	1 Each		
D3040		Air Handler, Single Zone, 8,000 Cfm	2006	1 Each		American Standard M#TWE120A300
D3040		Dehumidifier & Control, 120-150 lbs, 4,500 Cfm	2000	1 Each		
D3040		Duct Insulation, Fiberglass Blanket	2006	150 Sq Ft		
D3040		Ductwork	2006	350 Lbs		
D3040		Exhaust Fan, Propeller, 1,000 Cfm	1966	4 Each		
D3040		Residential Type Ceiling Fan	2000	4 Each		
D3050		Air Conditioner, DX Packaged, Air Cooled, 1 Ton	1994	8 Each		
D3050		Air Conditioner, Window, 1 Ton	2000	11 Each		
D3050		Heat Pump, 3 Ton	1990	2 Each		
D3050		Suspended Heater, Hot Water, 1,200 Cfm, 55 Mbh	1990	19 Each		
D3050		Suspended Heater, Hot Water, 2,000 Cfm, 180 Mbh	1990	8 Each		
D3060		Thermostat	1994	9 Each		
D4010		Fire Alarm Control Panel	2000	1 Each		
D4010		Fire Department Connection, Siamese, 3"	1990	1 Each		
D4010		Fire Sprinkler Head	1990	158 Each		
D4010		Fire Sprinkler System	1990	1 Each		
D4010		Pipe & Fittings, 1" Steel	1990	0.45 K Ln Ft		
D4010		Pipe & Fittings, 2" Steel	1990	0.1 K Ln Ft		
D4010		Pipe & Fittings, 4" Steel	1990	0.05 K Ln Ft		
D4010		Valves & Components, Sprinkler System, 3"	1990	1 Each		
D4030		Fire Extinguisher	2010	8 Each		
D5010		Disconnect Switch, 30 Amp.	1980	17 Each		
D5010		Disconnect Switch, 60 Amp.	1980	2 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

23-Dec-14

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	1980	2 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1990	1 Each		
D5010		Primary Transformer, Dry, 500 kVA	1980	1 Each		
D5010		Secondary Transformer, Dry, 150 kVA	1980	1 Each		
D5020		Emergency Lighting Pack, 2 Light w/ Battery	2005	9 Each		
D5020		Exit Lighting Fixture, w/ Battery	2000	5 Each		
D5020		Fluorescent Lighting Fixture, T8, 2-32w	1995	137 Each		
D5020		Fluorescent Lighting Fixture, T8, 4-32 w	1995	14 Each		
D5020		Incandescent Lighting Fixture, Basic, 100 w	1995	2 Each	Exterior	
D5020		LED Lighting Fixture, 100 w	2010	3 Each		Wall Mounted
D5020		Metal Halide Lighting Fixture, Wall Mount, 150 w	2010	2 Each		
D5020		Receptacle, 120 V, 15 Amp.	1990	60 Each		
D5020		Receptacle, 120 V, 15 Amp.	1966	50 Each		
D5020		Wiring Device, Switch	1995	30 Each		
D5030		Fire Alarm Bell, 6"	2000	4 Each		
D5030		Fire Alarm Horn & Strobe	2000	5 Each		
D5030		Gas Monitoring System	2005	1 Each		
D5030		Keypad	2010	1 Each		
D5030		Manual Pull Station	2000	6 Each		
D5030		Public Address Speaker	1990	6 Each		
D5030		Smoke Detector	2000	8 Each		
D5090		Battery Charger	1990	3 Each		
E1010		Icemaker, Commercial	2010	1 Each		
E1010		Microwave Oven	2010	1 Each		
E1010		Refrigerator, Domestic	2010	1 Each		
G3010		Post Indicator Valve	1990	1 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Building Extended Component List with Remaining Service Life

Whitestone Research 23-Dec-14

Building: Distribution Center

Year Built: 1966

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1206

City: Hampton, VA

Replacement Value: \$3,639,735 **per SF:** \$102

Building Gsft: 35,625

Uniformat	Asset Description	Component	Date	Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
B1010		Concrete Decking	1966	27	1223 Sq Ft					
B1010		Concrete Ramp	1966	27	399 Sq Ft					
B2010		Steel, Insulated Wall Panels, Painted, Exterior,	1966	-8	11810 Sq Ft	\$209,722	\$0	\$209,722		
B2020		Steel Operable Window, 12 sf, 1st Fl	1966	27	19 Each					
B2030		Steel, 14'x10', Painted, Overhead Coiling Door	1990	11	5 Each					
B2030		Steel, Painted, Exterior Door	1966	27	7 Each					
B2030		Steel, Painted, Exterior Double Door	1966	27	2 Each					
B3010		Aluminum Gutter, Downspouts, Fittings	1966	4	0.8 K Ln Ft					
B3010		Metal Canopy	1966	4	1733 Sq Ft					
B3010		Metal Roof	1966	4	36800 Sq Ft					sprayed with foam
C1010		Plexiglass Fixed Window, UV Filtering, 24 Sf	1966	27	5 Each					
C1010		Toilet Partitions, Painted Metal, Overhead Bra	1966	-28	4 Each	\$3,205	\$0	\$3,205		
C1020		Steel, 10'x8', Painted, Overhead Coiling Door,	1990	11	2 Each					
C1020		Steel, Painted, Interior Double Door w/ Safety	1966	27	1 Each					
C1020		Wood, Hollow Core, Painted, Interior Door	1966	-18	19 Each	\$9,949	\$0	\$9,949		
C2010		Concrete, Exterior Stairs	1966	2	131 Sq Ft					
C2010		Concrete, Interior Stairs	1966	27	39 Sq Ft				120	
C2010		Metal, Painted, Exterior Railing	1966	-18	107 Ln Ft	\$4,868	\$0	\$4,868		
C2010		Metal, Painted, Exterior Stairs	1966	2	31 Sq Ft					
C2010		Metal, Painted, Interior Railing	1966	2	70 Ln Ft					
C2010		Metal, Painted, Interior Stairs	1966	27	198 Sq Ft					

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Forecast Year: 2013

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

Uniformat	Asset Description	Component	Date	Remaining	Quantity	Deferred** Maintenance	Degradation Cost***	Total	Location	Notes
				Service Life*				Deferred Maintenance		
C3010		Ceramic Tile, 4"x4", Interior Wall Finish	1966	27	250 Sq Ft				104,107	
C3010		Ceramic Tile, 4"x4", Interior Wall Finish	1966	27	777 Sq Ft				109,112	
C3010		Concrete Block, Interior Wall Finish	1966	27	3829 Sq Ft				101	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	1730 Sq Ft				116	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	726 Sq Ft				105	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	812 Sq Ft				110	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	776 Sq Ft				109,112	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	944 Sq Ft				114	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	2257 Sq Ft				120	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	250 Sq Ft				104,107	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	599 Sq Ft				122,121,123	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	670 Sq Ft				119	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	7644 Sq Ft				108	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	179 Sq Ft				108E	
C3010		Concrete Block, Painted, Interior Wall Finish	1966	27	158 Sq Ft				108D	
C3010		Gypsum Board, Interior Wall Finish	1966	27	1636 Sq Ft				119	
C3010		Gypsum Board, Interior Wall Finish	1966	27	7698 Sq Ft				124,125,126,127,128,129, 130,131,H1A	
C3010		Gypsum Board, Interior Wall Finish	1966	27	2351 Sq Ft				122,121,123	
C3010		Gypsum Board, Interior Wall Finish	1966	27	438 Sq Ft				108D	
C3010		Gypsum Board, Interior Wall Finish	1966	27	965 Sq Ft				108B	
C3010		Gypsum Board, Interior Wall Finish	1966	27	445 Sq Ft				108E	
C3010		Gypsum Board, Interior Wall Finish	1966	27	1334 Sq Ft				120	
C3010		Gypsum Board, Interior Wall Finish	1966	27	425 Sq Ft				108	
C3010		Gypsum Board, Interior Wall Finish	1966	27	1192 Sq Ft				102,103,103A	
C3010		Gypsum Board, Interior Wall Finish	1966	27	734 Sq Ft				108A	
C3010		Gypsum Board, Interior Wall Finish	1966	27	334 Sq Ft				116	
C3010		Steel, Painted, Interior Wall Finish	1966	27	935 Sq Ft					
C3020		Carpet, Nylon 20 oz., High Traffic	1966	-40	1036 Sq Ft	\$7,476	\$0	\$7,476	108B,116	

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Forecast Year: 2013

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Uniformat	Asset Description	Component	Remaining Service Life*		Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
			Date	Life*						
C3020		Carpet, Nylon 20 oz., High Traffic	1966	-40	1080 Sq Ft	\$7,793	\$0	\$7,793	102,103,103A	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	-40	1792 Sq Ft	\$12,931	\$0	\$12,931	125,126,127,H1A,129,128,124,130,131	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	-40	779 Sq Ft	\$5,622	\$0	\$5,622	119	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	-40	961 Sq Ft	\$6,935	\$0	\$6,935	121,122,123	
C3020		Carpet, Nylon 20 oz., High Traffic	1966	-40	148 Sq Ft	\$1,068	\$0	\$1,068	108A	
C3020		Ceramic Tile Flooring	1966	2	314 Sq Ft				109,112	
C3020		Ceramic Tile Flooring	1966	2	151 Sq Ft				104	
C3020		Ceramic Tile Flooring	1966	2	49 Sq Ft				107	
C3020		Concrete Flooring	1966	27	145 Sq Ft					
C3020		Concrete Flooring	1966	27	2141 Sq Ft				120	
C3020		Concrete Flooring	1966	27	14726 Sq Ft				108,108D,108E,110	
C3020		Concrete Flooring	1966	27	7412 Sq Ft				101, above 102,103,103A	
C3020		Concrete Flooring	1966	27	230 Sq Ft				114	
C3020		Metal Floor Grating	1966	-18	4662 Sq Ft	\$65,438	\$0	\$65,438	108 2nd floor	
C3030		Acoustical Tile Ceiling	1966	22	310 Sq Ft				109,112	
C3030		Acoustical Tile Ceiling	1966	22	1768 Sq Ft				125,126,127,H1A,129,128,124,130,131	
C3030		Acoustical Tile Ceiling	1966	22	948 Sq Ft				121,122,123	
C3030		Acoustical Tile Ceiling	1966	22	48 Sq Ft				107	
C3030		Acoustical Tile Ceiling	1966	22	149 Sq Ft				104	
C3030		Acoustical Tile Ceiling	1966	22	1066 Sq Ft				102,103,103A	
C3030		Gypsum Board, Finished Ceiling	1966	27	768 Sq Ft				119	
C3030		Gypsum Board, Finished Ceiling	1966	27	1022 Sq Ft				108B,116	
C3030		Metal Ceiling	1966	27	5797 Sq Ft				101	
C3030		Metal Ceiling	1966	27	227 Sq Ft				114	
C3030		Metal Ceiling	1966	27	143 Sq Ft					
C3030		Metal Ceiling	1966	27	14527 Sq Ft				108,108D,108E,110	
C3030		Metal Ceiling	1966	27	2112 Sq Ft				120	
C3030		Plywood Ceiling, Painted	1966	-8	146 Sq Ft	\$1,168	\$0	\$1,168		

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Forecast Year: 2013

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Uniformat	Asset Description	Component	Remaining Service Life*		Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
			Date	Life*						
D1090		Dock Ramp Leveler	1966	-23	4 Each	\$38,427	\$0	\$38,427		
D2010		Emergency Eye Wash	1966	-23	1 Each	\$772	\$0	\$772		
D2010		Lavatory, Vitreous China	1966	-13	5 Each	\$2,165	\$0	\$2,165		
D2010		Service Sink, Iron, Enamel	1966	-13	1 Each	\$962	\$0	\$962		
D2010		Sink, Stainless Steel	1966	-8	1 Each	\$939	\$0	\$939		
D2010		Tankless Water Closet	1966	-13	6 Each	\$3,657	\$0	\$3,657		
D2010		Urinal, Vitreous China	1966	-13	4 Each	\$2,914	\$0	\$2,914		
D2010		Water Cooler, Electric	1995	-9	4 Each	\$4,505	\$0	\$4,505		
D2020		Hose Bib	1966	-38	1 Each	\$52	\$0	\$52		
D2020		Pipe & Fittings, 3/4" Copper, Cold Water	1966	-23	0.35 K Ln Ft	\$1,313	\$0	\$1,313		
D2020		Pipe & Fittings, 3/4" Copper, Hot Water	1966	-23	0.35 K Ln Ft	\$1,313	\$0	\$1,313		
D2020		Pipe Insulation, Fiberglass, Cold Water	1966	-23	0.35 K Ln Ft	\$274	\$0	\$274		
D2020		Pipe Insulation, Fiberglass, Hot Water	1966	-23	0.35 K Ln Ft	\$274	\$0	\$274		
D2020	Bradford-White MI20	Water Heater, Electric, 15 Gal.	1966	-33	1 Each	\$1,040	\$0	\$1,040		
D2020		Water Heater, Electric, 5 Gal.	1966	-33	1 Each	\$714	\$0	\$714		6 Gal
D2030		Backflow Preventer, 2"	2000	-4	2 Each	\$3,556	\$0	\$3,556		
D2030		Backflow Preventer, 3/4"	2000	-4	1 Each	\$827	\$0	\$827		
D2030		Floor Drain	1966	-8	1 Each	\$283	\$0	\$283		
D2030		Pipe & Fittings, 2" PVC	1990	6	0.05 K Ln Ft					
D2030		Pipe & Fittings, 3" Cast Iron	1966	27	0.3 K Ln Ft					
D2030		Pipe & Fittings, 4" Cast Iron	1966	27	0.1 K Ln Ft					
D3010		Pressure Reducer Valve, 2"	1966	-42	2 Each	\$1,562	\$0	\$1,562		
D3020		Boiler, Gas, 100 Mbh	2000	14	1 Each					
D3020		Condensate Removal Pump System, 1/50 HP	2006	6	1 Each					
D3020		Gate Valve, 6"	1966	-29	2 Each	\$4,309	\$0	\$4,309		
D3020		Heat Exchanger, Steam-to-Water, 15 Gpm	2006	20	1 Each					
D3020		Pipe & Fittings, 10" Steel	1966	27	0.05 K Ln Ft					
D3020		Pipe & Fittings, 2" Steel	1966	27	0.35 K Ln Ft					

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Forecast Year: 2013

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Uniformat	Asset Description	Component	Date	Remaining	Quantity	Deferred**	Degradation	Total	Location	Notes
				Service						
D3020		Pipe & Fittings, 4" Steel	1966	27	0.1 K Ln Ft					
D3020		Pipe Insulation, Fiberglass, Heating Water/Ste	1966	-23	0.35 K Ln Ft	\$382	\$0	\$382		
D3020		Steam Trap, F&T, 2"	1966	-39	40 Each	\$33,955	\$0	\$33,955		
D3020		Valve, Non-Drain, 10"	1966	-29	2 Each	\$11,669	\$0	\$11,669		Steam Valve
D3030		Ball Valve, 1"	1966	-31	6 Each	\$2,032	\$0	\$2,032		Relief Valve
D3030		Condenser, Air-Cooled, 1 Ton	1994	9	8 Each					
D3030		Condenser, Air-Cooled, 10 Ton	2006	21	1 Each					
D3030		Expansion Tank, 30 Gal.	1966	2	1 Each					
D3040		Air Handler, Single Zone, 8,000 Cfm	2006	7	1 Each					American Standard
D3040		Dehumidifier & Control, 120-150 lbs, 4,500 Cf	2000	5	1 Each					M#TWE120A300
D3040		Duct Insulation, Fiberglass Blanket	2006	24	150 Sq Ft					
D3040		Ductwork	2006	24	350 Lbs					
D3040		Exhaust Fan, Propeller, 1,000 Cfm	1966	-29	4 Each	\$3,950	\$0	\$3,950		
D3040		Residential Type Ceiling Fan	2000	6	4 Each					
D3050		Air Conditioner, DX Packaged, Air Cooled, 1 T	1994	12	8 Each					
D3050		Air Conditioner, Window, 1 Ton	2000	18	11 Each					
D3050		Heat Pump, 3 Ton	1990	8	2 Each					
D3050		Suspended Heater, Hot Water, 1,200 Cfm, 55	1990	5	19 Each					
D3050		Suspended Heater, Hot Water, 2,000 Cfm, 18	1990	5	8 Each					
D3060		Thermostat	1994	-10	9 Each	\$3,184	\$0	\$3,184		
D4010		Fire Alarm Control Panel	2000	1	1 Each					
D4010		Fire Department Connection, Siamese, 3"	1990	26	1 Each					
D4010		Fire Sprinkler Head	1990	26	158 Each					
D4010		Fire Sprinkler System	1990	NA	1 Each					
D4010		Pipe & Fittings, 1" Steel	1990	51	0.45 K Ln Ft					
D4010		Pipe & Fittings, 2" Steel	1990	51	0.1 K Ln Ft					
D4010		Pipe & Fittings, 4" Steel	1990	51	0.05 K Ln Ft					
D4010		Valves & Components, Sprinkler System, 3"	1990	-4	1 Each	\$3,210	\$0	\$3,210		

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Forecast Year: 2013

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

Uniformat	Asset Description	Component	Date	Remaining	Quantity	Deferred** Maintenance	Degradation Cost***	Total	Location	Notes
				Service Life*				Deferred Maintenance		
D4030		Fire Extinguisher	2010	8	8 Each					
D5010		Disconnect Switch, 30 Amp.	1980	16	17 Each					
D5010		Disconnect Switch, 60 Amp.	1980	16	2 Each					
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	1980	-4	2 Each	\$7,898	\$0	\$7,898		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1990	6	1 Each					
D5010		Primary Transformer, Dry, 500 kVA	1980	-4	1 Each	\$53,292	\$0	\$53,292		
D5010		Secondary Transformer, Dry, 150 kVA	1980	-4	1 Each	\$11,773	\$0	\$11,773		
D5020		Emergency Lighting Pack, 2 Light w/ Battery	2005	11	9 Each					
D5020		Exit Lighting Fixture, w/ Battery	2000	6	5 Each					
D5020		Fluorescent Lighting Fixture, T8, 2-32w	1995	1	137 Each					
D5020		Fluorescent Lighting Fixture, T8, 4-32 w	1995	1	14 Each					
D5020		Incandescent Lighting Fixture, Basic, 100 w	1995	1	2 Each				Exterior	
D5020		LED Lighting Fixture, 100 w	2010	16	3 Each					Wall Mounted
D5020		Metal Halide Lighting Fixture, Wall Mount, 150	2010	16	2 Each					
D5020		Receptacle, 120 V, 15 Amp.	1966	-28	50 Each	\$2,106	\$0	\$2,106		
D5020		Receptacle, 120 V, 15 Amp.	1990	-4	60 Each	\$2,527	\$0	\$2,527		
D5020		Wiring Device, Switch	1995	-4	30 Each	\$1,027	\$0	\$1,027		
D5030		Fire Alarm Bell, 6"	2000	6	4 Each					
D5030		Fire Alarm Horn & Strobe	2000	6	5 Each					
D5030		Gas Monitoring System	2005	6	1 Each					
D5030		Keypad	2010	6	1 Each					
D5030		Manual Pull Station	2000	1	6 Each					
D5030		Public Address Speaker	1990	-9	6 Each	\$1,674	\$0	\$1,674		
D5030		Smoke Detector	2000	1	8 Each					
D5090		Battery Charger	1990	-4	3 Each	\$3,435	\$0	\$3,435		
E1010		Icemaker, Commercial	2010	6	1 Each					
E1010		Microwave Oven	2010	6	1 Each					
E1010		Refrigerator, Domestic	2010	6	1 Each					

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

All costs expressed in (\$) 2012.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

Forecast Year: 2013

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

Uniformat	Asset Description	Component	Date	Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
G3010		Post Indicator Valve	1990	11	1 Each					

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

M&R Costs by System per Year Chart

Building: Distribution Center

Facility: Langley Research Center

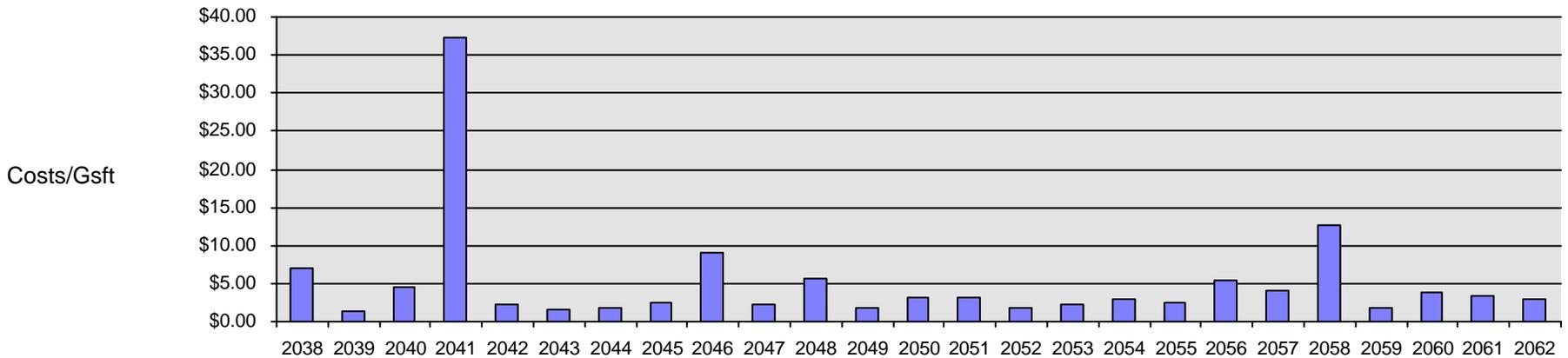
City: Hampton, VA

Building Num: 1206

GSFT: 35625

Forecast Year: 2038 9 0 1 2 2043 4 5 6 7 2048 9 0 1 2 2053 4 5 6 7 2058 9 0 1 2 **Total**

A10 Foundations																									0.00	
A20 Basement Construction																									0.00	
B10 Super Structure																									1.25	
B20 Exterior Enclosure	0.03	0.03	0.03	2.19	0.03	0.03	0.03	0.15	5.93	0.03	0.03	0.03	0.03	0.14	0.03	0.03	0.03	0.15	0.50	0.03	0.03	0.03	1.08	0.15	0.03	14.77
B30 Roofing	0.99	0.23	0.23	0.23	0.23	0.47	0.23	0.23	0.23	0.23	2.26	0.23	0.23	0.23	0.23	0.47	0.23	0.23	0.23	0.23	11.05	0.23	0.23	0.23	0.23	39.27
C10 Interior Construction	0.03	0.01	0.01	0.27	0.03	0.01	0.01	0.06	0.32	0.01	0.01	0.02	0.03	0.06	0.01	0.02	0.03	0.06	0.31	0.02	0.02	0.01	0.26	0.06	0.02	3.39
C20 Stairs	0.01	0.00		0.22	0.00		0.01	0.02	0.00		0.01	0.00		0.01	0.00		0.01	0.16		0.01	0.00		0.02	0.00		0.88
C30 Interior Finishes	1.69	0.02		30.62	0.02	0.02		0.21	1.29	0.02		0.51	0.02	1.06	0.02	0.20	1.18	1.97		0.51	0.02	0.02		1.29	1.17	55.14
D10 Conveying	0.06	0.06	0.06	1.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	4.92
D20 Plumbing	0.04	0.03	0.14	0.27	0.03	0.05	0.04	0.15	0.09	0.03	0.04	0.03	0.17	0.04	0.03	0.04	0.03	0.15	0.12	0.05	0.03	0.03	0.14	0.04	0.04	3.79
D30 HVAC	3.93	0.89	0.73	1.26	1.55	0.72	1.28	0.72	0.77	1.61	3.06	0.78	1.20	1.33	1.33	1.18	1.08	0.73	1.86	2.89	1.25	1.15	0.73	1.30	1.28	66.56
D40 Fire Protection	0.07	0.08	0.38	0.07	0.07	0.07	0.08	0.15	0.13	0.07	0.07	0.07	0.33	0.08	0.07	0.07	0.07	0.07	0.08	0.07	0.13	0.07	0.32	0.07	0.07	5.17
D50 Electrical	0.07	0.07	2.35	0.07	0.07	0.07	0.07	0.83	0.13	0.07	0.07	0.07	0.67	0.07	0.07	0.07	0.07	0.88	0.07	0.07	0.07	0.07	0.33	0.07	0.07	11.90
E10 Equipment	0.05	0.05	0.52	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.52	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.52	0.05	0.05	4.74	
E20 Furnishings																									0.00	
F10 Special Construction																									0.00	
F20 Selective Bldg Demolition																									0.00	
G10 Site Preparation																									0.00	
G20 Site Improvements																									0.00	
G30 Site Mechanical Utilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.22
G40 Site Electrical Utilities																									0.00	
G90 Other Site Construction																									0.00	
Total	6.97	1.45	4.48	37.31	2.15	1.53	1.87	2.59	9.02	2.17	5.68	1.86	3.27	3.15	1.91	2.19	2.83	2.38	5.41	3.98	12.71	1.71	3.76	3.40	3.02	212.01



Notes: A value of "0.00" means cost of more than \$.000 but less than \$.005 per gsft. All costs expressed in (\$) 2012 per gsft. Year 26-50 Based on a 50-Year Forecast.

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Replace Metal, Painted, Exterior Stairs				1,000																					
Finish Replaced Metal, Painted, Exterior Stairs				30																					
Repair Metal, Painted, Interior Stairs														463											
Replace Metal, Painted, Interior Railing				1,869																					
Finish Replaced Metal, Painted, Interior Stairs																									
Replace Metal, Painted, Interior Stairs																									
Repair Concrete, Interior Stairs														93											
Finish Repaired Metal, Painted, Interior Stairs														6											
Finish Repaired Metal, Painted, Interior Railing																			2						
Replace Concrete, Exterior Stairs				4,233																					
Replace Concrete, Interior Stairs																									
Refinish Metal, Painted, Exterior Railing				111																				111	
Finish Repaired Metal, Painted, Exterior Railing																									
Replace Metal, Painted, Exterior Railing														4,868											
Repair Metal, Painted, Interior Railing																			97						
Finish Replaced Metal, Painted, Exterior Railing														106											
Refinish Metal, Painted, Interior Railing		70						70					70							70					70
Repair Metal, Painted, Exterior Railing																									
Repair Concrete, Exterior Stairs																									319

C30 Interior Finishes

Replace Carpet, Nylon 20 oz., High Traffic	41,824									41,824										41,824					
Repair Acoustic Tile Ceiling (2% of Ceiling)							224												224						
Replace Metal Floor Grating														65,438											
Repair Metal Floor Grating (2% of Grating)				2,634																				2,634	
Replace Concrete Flooring																									
Repair Concrete Flooring (2% of Floors)														3,611											
Repair Ceramic Tile Flooring (2% of Floors)																									195
Replace Metal Ceiling																									
Repair Carpet, Nylon 20 oz., High Traffic (2% of Carpet)				835		835		835					835	835		835				835		835		835	
Replace Ceramic Tile Flooring				6,445																					
Refinish Gypsum Board, Finished Ceiling				2,374										2,374										2,374	
Finish Repaired Gypsum Board, Finished Ceiling				47																					
Replace Gypsum Board, Finished Ceiling																									
Finish Replaced Steel, Painted, Interior Wall Finish																									
Repair Metal Ceiling (2% of Ceiling)		11,183									11,183									11,183					
Replace Acoustic Tile Ceiling																								11,274	
Refinish Plywood Ceiling, Painted				194										194										194	

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Metal, Painted, Exterior Stairs																									
Finish Replaced Metal, Painted, Exterior Stairs																									
Repair Metal, Painted, Interior Stairs																			463						
Replace Metal, Painted, Interior Railing																									
Finish Replaced Metal, Painted, Interior Stairs				196																					
Replace Metal, Painted, Interior Stairs				6,385																					
Repair Concrete, Interior Stairs																								93	
Finish Repaired Metal, Painted, Interior Stairs																			6						
Finish Repaired Metal, Painted, Interior Railing									2															2	
Replace Concrete, Exterior Stairs																									
Replace Concrete, Interior Stairs				1,237																					
Refinish Metal, Painted, Exterior Railing									111																
Finish Repaired Metal, Painted, Exterior Railing				3																					
Replace Metal, Painted, Exterior Railing																			4,868						
Repair Metal, Painted, Interior Railing									97															97	
Finish Replaced Metal, Painted, Exterior Railing																			106						
Refinish Metal, Painted, Interior Railing			70			70					70				70				70				70		
Repair Metal, Painted, Exterior Railing				147																					
Repair Concrete, Exterior Stairs									319															319	

C30 Interior Finishes

Replace Carpet, Nylon 20 oz., High Traffic	41,824								41,824							41,824									41,824
Repair Acoustic Tile Ceiling (2% of Ceiling)								224								224									
Replace Metal Floor Grating																			65,438						
Repair Metal Floor Grating (2% of Grating)									2,634																
Replace Concrete Flooring				180,552																					
Repair Concrete Flooring (2% of Floors)																			3,611						
Repair Ceramic Tile Flooring (2% of Floors)									195															195	
Replace Metal Ceiling				563,354																					
Repair Carpet, Nylon 20 oz., High Traffic (2% of Carpet)		835			835		835				835		835		835				835		835		835		
Replace Ceramic Tile Flooring																									
Refinish Gypsum Board, Finished Ceiling																2,374								2,374	
Finish Repaired Gypsum Board, Finished Ceiling																									
Replace Gypsum Board, Finished Ceiling				8,003																					
Finish Replaced Steel, Painted, Interior Wall Finish				1,999																					
Repair Metal Ceiling (2% of Ceiling)	11,183										11,183												11,183		
Replace Acoustic Tile Ceiling																									
Refinish Plywood Ceiling, Painted																								194	

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Repair Plywood Ceiling, Painted (2% of Ceiling)				23										23											23	
Replace Plywood Ceiling																										
Finish Replaced Gypsum Board, Finished Ceiling																										
Replace Ceramic Tile, 4"x4", Interior Wall Finish																										
Repair Gypsum Board, Finished Ceiling (2% of Ceiling)				160																						
Replace Steel, Painted, Interior Wall Finish																										
Repair Ceramic Tile, 4"x4", Interior Wall Finish (2% of Walls)				225										225											225	
Clean & Seal Concrete Block, Interior Wall Finish		4,818				4,818				4,818				4,818				4,818						4,818		
Repair Concrete Block, Interior Wall Finish (2% of Walls)				846																						
Repoint (50% surface) Concrete Block, Interior Wall Finish				9,376																						
Replace Concrete Block, Interior Wall Finish																										
Refinish Concrete Block, Painted, Interior Wall Finish				16,845										16,845											16,845	
Repair Concrete Block, Painted, Interior Wall Finish (2% of Wal				3,704																						
Repoint (50% surface) Concrete Block, Painted, Interior Wall Fi				41,002																						
Refinish Steel, Painted, Interior Wall Finish				997										997											997	
Replace Concrete Block, Painted, Interior Wall Finish																										
Finish Replaced Concrete Block, Painted, Interior Wall Finish																										
Refinish Gypsum Board, Interior Wall Finish				17,238										17,238											17,238	
Repair Gypsum Board, Interior Wall Finish (2% of Walls)														753												
Finish Repaired Gypsum Board, Interior Wall Finish														345												
Replace Gypsum Board, Interior Wall Finish																										
Finish Replaced Gypsum Board, Interior Wall Finish																										
Finish Repaired Steel, Painted, Interior Wall Finish				20																						
Repair Steel, Painted, Interior Wall Finish (2% of Walls)				474																						
Finish Repaired Concrete Block, Painted, Interior Wall Finish				337																						

D10 Conveying

Replace Dock Ramp Leveler				38,427																						
Maintain Dock Ramp Leveler	1,615	1,615	1,615		1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615

D20 Plumbing

Replace Pipe & Fittings, 3/4" Copper, Cold Water (20% of Pipe				1,313																						
Replace Urinal, Vitreous China																									2,914	
Replace Valve, Hose Bib				52										52											52	
Resolder Joint, Pipe & Fittings, 3/4" Copper, Cold Water														120											120	
Re-tape Pipe Insulation, Fiberglass, Hot Water									91					91					91						91	
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Cold Water																									66	
Replace Tankless Water Closet																									3,657	

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2	
Repair Plywood Ceiling, Painted (2% of Ceiling)																										23
Replace Plywood Ceiling									1,168																	
Finish Replaced Gypsum Board, Finished Ceiling				2,374																						
Replace Ceramic Tile, 4"x4", Interior Wall Finish				11,299																						
Repair Gypsum Board, Finished Ceiling (2% of Ceiling)																										
Replace Steel, Painted, Interior Wall Finish				23,872																						
Repair Ceramic Tile, 4"x4", Interior Wall Finish (2% of Walls)														225											225	
Clean & Seal Concrete Block, Interior Wall Finish	4,818						4,818					4,818				4,818				4,818				4,818		
Repair Concrete Block, Interior Wall Finish (2% of Walls)																										
Repoint (50% surface) Concrete Block, Interior Wall Finish																										
Replace Concrete Block, Interior Wall Finish				42,330																						
Refinish Concrete Block, Painted, Interior Wall Finish																			16,845						16,845	
Repair Concrete Block, Painted, Interior Wall Finish (2% of W																										
Repoint (50% surface) Concrete Block, Painted, Interior Wall																										
Refinish Steel, Painted, Interior Wall Finish																			997						997	
Replace Concrete Block, Painted, Interior Wall Finish				185,118																						
Finish Replaced Concrete Block, Painted, Interior Wall Finish				16,845																						
Refinish Gypsum Board, Interior Wall Finish																			17,238						17,238	
Repair Gypsum Board, Interior Wall Finish (2% of Walls)																										753
Finish Repaired Gypsum Board, Interior Wall Finish																										345
Replace Gypsum Board, Interior Wall Finish				37,679																						
Finish Replaced Gypsum Board, Interior Wall Finish				17,238																						
Finish Repaired Steel, Painted, Interior Wall Finish																										
Repair Steel, Painted, Interior Wall Finish (2% of Walls)																										
Finish Repaired Concrete Block, Painted, Interior Wall Finish																										

D10 Conveying

Replace Dock Ramp Leveler				38,427																						
Maintain Dock Ramp Leveler	1,615	1,615	1,615		1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	1,615	

D20 Plumbing

Replace Pipe & Fittings, 3/4" Copper, Cold Water (20% of Pip				1,313																						
Replace Urinal, Vitreous China																										
Replace Valve, Hose Bib									52										52							
Resolder Joint, Pipe & Fittings, 3/4" Copper, Cold Water																										120
Re-tape Pipe Insulation, Fiberglass, Hot Water									91										91							91
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Cold Water																										66
Replace Tankless Water Closet																										

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Replace Flush Valve, Urinal, Vitreous China			516							516							516								
Resolder Joint, Pipe & Fittings, 3/4" Copper, Hot Water														120											120
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Hot Water																									66
Replace Pipe & Fittings, 3/4" Copper, Hot Water (20% of Pipe)				1,313																					
Check Operation, Water Heater, Electric, 5 Gal.		19			19			19			19						19			19				19	
Replace Pipe Insulation, Fiberglass, Cold Water (20% of Insula				274																					
Replace Pipe Insulation, Fiberglass, Hot Water (20% of Insulati				274																					
Replace Flush Valve, Tankless Water Closet				115										115											
Replace Emergency Eye Wash Station				772																					
Re-tape Pipe Insulation, Fiberglass, Cold Water									91					91					91					91	
Replace Faucet Washer & Clean Trap, Sink, Iron, Enamel		19		19		19		19		19		19		19		19		19		19		19		19	
Check Operation, Water Heater, Electric, 15 Gal.		19			19			19			19						19			19				19	
Replace Coolant & Adjust Water Cooler, Electric		97			97		97		97		97				97		97		97		97			97	97
Replace Water Cooler, Electric			4,505										4,505											4,505	
Inspect & Clean Spray Heads, Emergency Eye Wash		19					19			19						19			19				19		19
Repack Valve Glands, Emergency Eye Wash														23											23
Replace Faucet Washer & Clean Trap, Lavatory, Vitreous Chin		98		98		98		98		98		98		98		98		98		98		98		98	
Replace Washer & Spud Connection, Lavatory, Vitreous China			181							181							181								
Replace Lavatory, Vitreous China																									2,165
Replace Sink, Stainless Steel																									
Repair Strainer, Sink, Iron, Enamel		58								58									58						
Replace Valve Set, Service Sink, Iron, Enamel				123										123											
Replace Service Sink, Iron, Enamel																									962
Replace Faucet Washer & Clean Trap, Sink, Stainless Steel		19		19		19		19		19		19		19		19		19		19		19		19	
Repair Strainer, Sink, Stainless Steel		57								57									57						
Replace Valve Set, Sink, Stainless Steel				123										123											123
Replace Valve Set, Lavatory, Vitreous China				616										616											
Replace 10' Section, Pipe & Fittings, 2" DWV PVC																									12
Replace Water Heater, Electric, 5 Gal.														714											
Drain & Flush Water Heater, Electric, 5 Gal.			78							78														78	
Replace Pipe & Fittings, 2" DWV PVC (20% of Pipe)								253																	
Replace Pipe & Fittings, 4" Cast Iron (20% of Pipe)																									
Install New Gasket & Bolts, Pipe & Fittings, 4" Cast Iron				16																					
Replace 10' Section, Pipe & Fittings, 4" Cast Iron		57												57											
Replace Pipe & Fittings, 3" Cast Iron (20% of Pipe)																									
Install New Gasket & Bolts, Pipe & Fittings, 3" Cast Iron				35																					
Replace 10' Section, Pipe & Fittings, 3" Cast Iron		100												100											

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2	
Replace Flush Valve, Urinal, Vitreous China						516										516										
Resolder Joint, Pipe & Fittings, 3/4" Copper, Hot Water																										120
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Hot Water																										66
Replace Pipe & Fittings, 3/4" Copper, Hot Water (20% of Pipe						1,313																				
Check Operation, Water Heater, Electric, 5 Gal.	19						19				19					19						19				19
Replace Pipe Insulation, Fiberglass, Cold Water (20% of Insul						274																				
Replace Pipe Insulation, Fiberglass, Hot Water (20% of Insula						274																				
Replace Flush Valve, Tankless Water Closet											115											115				
Replace Emergency Eye Wash Station						772																				
Re-tape Pipe Insulation, Fiberglass, Cold Water											91					91						91				91
Replace Faucet Washer & Clean Trap, Sink, Iron, Enamel	19		19			19					19					19					19					19
Check Operation, Water Heater, Electric, 15 Gal.	19						19				19					19						19				19
Replace Coolant & Adjust Water Cooler, Electric			97			97					97					97						97				97
Replace Water Cooler, Electric											4,505											4,505				
Inspect & Clean Spray Heads, Emergency Eye Wash			19				19				19					19						19				19
Repack Valve Glands, Emergency Eye Wash																23										23
Replace Faucet Washer & Clean Trap, Lavatory, Vitreous Chi	98		98			98					98					98						98				98
Replace Washer & Spud Connection, Lavatory, Vitreous Chin						181										181										181
Replace Lavatory, Vitreous China																										
Replace Sink, Stainless Steel											939															
Repair Strainer, Sink, Iron, Enamel							58									58										58
Replace Valve Set, Service Sink, Iron, Enamel											123											123				
Replace Service Sink, Iron, Enamel																										
Replace Faucet Washer & Clean Trap, Sink, Stainless Steel	19		19			19					19					19						19				19
Repair Strainer, Sink, Stainless Steel	57																57									57
Replace Valve Set, Sink, Stainless Steel																						123				
Replace Valve Set, Lavatory, Vitreous China											616											616				
Replace 10' Section, Pipe & Fittings, 2" DWV PVC			12																							12
Replace Water Heater, Electric, 5 Gal.						714																				714
Drain & Flush Water Heater, Electric, 5 Gal.			78																							78
Replace Pipe & Fittings, 2" DWV PVC (20% of Pipe)																253										
Replace Pipe & Fittings, 4" Cast Iron (20% of Pipe)						1,124																				
Install New Gasket & Bolts, Pipe & Fittings, 4" Cast Iron																										
Replace 10' Section, Pipe & Fittings, 4" Cast Iron	57																57									
Replace Pipe & Fittings, 3" Cast Iron (20% of Pipe)						2,005																				
Install New Gasket & Bolts, Pipe & Fittings, 3" Cast Iron																										
Replace 10' Section, Pipe & Fittings, 3" Cast Iron	100																100									

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Replace Water Heater, Electric, 15 Gal.																										
Replace Floor Drain																										
Drain & Flush Water Heater, Electric, 15 Gal.			156							156											156					
Maintain Backflow Preventer, 3/4"	45	45	45	45	45	45	45		45	45	45	45	45	45	45	45	45		45	45	45	45	45	45	45	
Replace Backflow Preventer, 3/4"										827											827					
Maintain Backflow Preventer, 2"	208	208	208	208	208	208	208		208	208	208	208	208	208	208	208	208		208	208	208	208	208	208	208	
Replace Backflow Preventer, 2"										3,556											3,556					
Maintain Floor Drain	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	
D30 HVAC																										
Maintain Exhaust Fan, Propeller, 1,000 Cfm	367	367	367	367	367	367	367	367	367	367		367	367	367	367	367	367	367	367	367	367	367	367	367	367	
Repair Condenser, Air-Cooled, 10 Ton										1,296																
Maintain Dehumidifier & Control, 120-150 lbs, 4,500 Cfm	618	618	618	618	618	618		618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	
Maintain Residential Type Ceiling Fan	256	256	256	256	256	256	256		256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	
Replace Existing Ductwork (20% of Ductwork)																										
Replace Duct Insulation (20% of Insulation)																										
Replace Dehumidifier & Control, 120-150 lbs, 4,500 Cfm										78,242																
Replace Residential Type Ceiling Fan										762																
Replace Air Handler, Single Zone, 8,000 Cfm										19,236															19,236	
Repair Air Handler, Single Zone, 8,000 Cfm										1,550											1,550					
Replace Condenser, Air-Cooled, 10 Ton																									5,606	
Replace Expansion Tank, 30 Gal.										1,703																
Maintain Expansion Tank, 30 Gal.	19	19	19		19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	
Repair Exhaust Fan, Propeller, 1,000 Cfm										759															759	
Maintain Suspended Heater, Hot Water, 1,200 Cfm, 55 Mbh	3,991	3,991	3,991	3,991	3,991	3,991		3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991		
Maintain Air Handler, Single Zone, 8,000 Cfm	473	473	473	473	473	473	473	473		473	473	473	473	473	473	473	473	473	473	473	473	473	473	473		
Maintain Heat Pump, 3 Ton	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167		1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167		
Replace Thermostat																									3,184	
Maintain Thermostat	174		174	174	174	174	174	174	174	174	174		174	174	174	174	174	174	174	174	174		174	174	174	
Repair Suspended Heater, Hot Water, 2,000 Cfm, 180 Mbh																									3,394	
Replace Suspended Heater, Hot Water, 1,200 Cfm, 55 Mbh																									63,660	
Repair Suspended Heater, Hot Water, 1,200 Cfm, 55 Mbh																									8,051	
Maintain Suspended Heater, Hot Water, 2,000 Cfm, 180 Mbh	1,680	1,680	1,680	1,680	1,680	1,680		1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680		
Repair Heat Pump, 3 Ton																										
Maintain Condenser, Air-Cooled, 10 Ton	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105		105	105	
Replace Exhaust Fan, Propeller, 1,000 Cfm																									3,950	
Replace Air Conditioner, Window, 1 Ton																									15,737	
Repair Air Conditioner, Window, 1 Ton																									1,118	

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2	
Replace Water Heater, Electric, 15 Gal.						1,040																				1,040
Replace Floor Drain											283															
Drain & Flush Water Heater, Electric, 15 Gal.						156										156										156
Maintain Backflow Preventer, 3/4"	45	45		45	45	45	45	45	45	45	45	45				45	45	45	45	45	45	45	45		45	45
Replace Backflow Preventer, 3/4"						827										827										827
Maintain Backflow Preventer, 2"	208	208		208	208	208	208	208	208	208	208	208				208	208	208	208	208	208	208	208		208	208
Replace Backflow Preventer, 2"						3,556										3,556										3,556
Maintain Floor Drain	22	22	22	22	22	22	22	22			22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22

D30 HVAC

Maintain Exhaust Fan, Propeller, 1,000 Cfm	367	367	367	367		367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
Repair Condenser, Air-Cooled, 10 Ton																										1,296
Maintain Dehumidifier & Control, 120-150 lbs, 4,500 Cfm		618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618
Maintain Residential Type Ceiling Fan	256	256		256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256		256	256	
Replace Existing Ductwork (20% of Ductwork)																										554
Replace Duct Insulation (20% of Insulation)																										122
Replace Dehumidifier & Control, 120-150 lbs, 4,500 Cfm																										78,242
Replace Residential Type Ceiling Fan																										762
Replace Air Handler, Single Zone, 8,000 Cfm																										19,236
Repair Air Handler, Single Zone, 8,000 Cfm																										1,550
Replace Condenser, Air-Cooled, 10 Ton																										
Replace Expansion Tank, 30 Gal.																										
Maintain Expansion Tank, 30 Gal.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Repair Exhaust Fan, Propeller, 1,000 Cfm																										759
Maintain Suspended Heater, Hot Water, 1,200 Cfm, 55 Mbh	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991
Maintain Air Handler, Single Zone, 8,000 Cfm	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473
Maintain Heat Pump, 3 Ton	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167
Replace Thermostat																										3,184
Maintain Thermostat	174	174	174	174	174	174					174	174	174	174	174	174										174
Repair Suspended Heater, Hot Water, 2,000 Cfm, 180 Mbh																										
Replace Suspended Heater, Hot Water, 1,200 Cfm, 55 Mbh																										63,660
Repair Suspended Heater, Hot Water, 1,200 Cfm, 55 Mbh																										
Maintain Suspended Heater, Hot Water, 2,000 Cfm, 180 Mbh	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
Repair Heat Pump, 3 Ton																										2,925
Maintain Condenser, Air-Cooled, 10 Ton	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105
Replace Exhaust Fan, Propeller, 1,000 Cfm																										3,950
Replace Air Conditioner, Window, 1 Ton																										
Repair Air Conditioner, Window, 1 Ton																										1,118

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Maintain Air Conditioner, Window, 1 Ton	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174
Replace Air Conditioner, DX Packaged, Air Cooled, 1 Ton																									
Repair Air Conditioner, DX Packaged, Air Cooled, 1 Ton																									
Maintain Air Conditioner, DX Packaged, Air Cooled, 1 Ton	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077
Replace Heat Pump, 3 Ton																									
Repair Boiler, Gas, 100 Mbh		2,391							2,391																
Repair Heat Exchanger, Steam-to-Water, 15 Gpm	486							486							486										
Maintain Heat Exchanger, Steam-to-Water, 15 Gpm	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70		70	70	70
Repack Gland, Gate Valve, 6"																									
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel																									
Replace 10' Section, Pipe & Fittings, 2" Steel																									
Replace Condensate Removal Pump System, 1/50 HP																									
Replace Heat Exchanger, Steam-to-Water, 15 Gpm																									
Replace Boiler, Gas, 100 Mbh																									
Replace Gate Valve, 6"																									
Clean Fire Box Boiler, Gas, 100 Mbh																									
Inspect & Test Boiler, Gas, 100 Mbh	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257
Replace Pressure Reducer Valve, 2"																									
Maintain Pressure Reducer Valve, 2"	38		38	38	38	38	38		38	38	38	38	38		38	38	38	38	38	38		38	38	38	38
Replace Suspended Heater, Hot Water, 2,000 Cfm, 180 Mbh																									
Replace Condenser, Air-Cooled, 1 Ton																									
Maintain Condensate Removal Pump System, 1/50 HP	59	59	59	59	59	59	59		59	59	59	59	59	59	59	59	59	59	59	59	59		59	59	59
Lubricate, Repack Gland, Valve, Non Drain, 10"	56	56	56	56	56	56	56	56	56	56		56	56	56	56	56	56	56	56	56	56	56	56	56	56
Repair Condenser, Air-Cooled, 1 Ton																									
Maintain Condenser, Air-Cooled, 1 Ton	840	840	840	840	840	840	840	840	840	840		840	840	840	840	840	840	840	840	840	840	840	840	840	840
Replace Ball Valve, 1"																									
Replace Pipe & Fittings, 2" Steel (20% of Pipe)																									
Replace Valve, Non-Drain, 10"																									
Replace 10' Section, Pipe & Fittings, 4" Steel																									
Replace Steam Trap, F&T, 2"																									
Repair Steam Trap, F&T, 2"																									
Maintain Steam Trap, F&T, 2"	1,167	1,167	1,167	1,167	1,167	1,167	1,167		1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167
Install New Gasket & Bolts, Pipe & Fittings, 4" Steel																									
Re-tape Pipe Insulation, Fiberglass, Heating Water/Steam																									
Replace Pipe & Fittings, 10" Steel (20% of Pipe)																									
Install New Gasket & Bolts, Pipe & Fittings, 10" Steel																									
Replace 10' Section, Pipe & Fittings, 10" Steel																									

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Maintain Air Conditioner, Window, 1 Ton	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174	1,174
Replace Air Conditioner, DX Packaged, Air Cooled, 1 Ton																									22,479
Repair Air Conditioner, DX Packaged, Air Cooled, 1 Ton					8,036																				
Maintain Air Conditioner, DX Packaged, Air Cooled, 1 Ton	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077	2,077		2,077	2,077	2,077	2,077
Replace Heat Pump, 3 Ton																									11,821
Repair Boiler, Gas, 100 Mbh					2,391							2,391													
Repair Heat Exchanger, Steam-to-Water, 15 Gpm				486							486								486						
Maintain Heat Exchanger, Steam-to-Water, 15 Gpm	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Repack Gland, Gate Valve, 6"				96									96										96		
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel																									
Replace 10' Section, Pipe & Fittings, 2" Steel	65																65								
Replace Condensate Removal Pump System, 1/50 HP											321														321
Replace Heat Exchanger, Steam-to-Water, 15 Gpm																									2,817
Replace Boiler, Gas, 100 Mbh																									7,685
Replace Gate Valve, 6"					4,309																				4,309
Clean Fire Box Boiler, Gas, 100 Mbh	65		65		65		65		65		65		65		65		65		65		65		65		65
Inspect & Test Boiler, Gas, 100 Mbh	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257
Replace Pressure Reducer Valve, 2"	1,562					1,562							1,562						1,562						1,562
Maintain Pressure Reducer Valve, 2"		38	38	38	38	38		38	38	38	38	38		38	38	38	38	38			38	38	38	38	38
Replace Suspended Heater, Hot Water, 2,000 Cfm, 180 Mbh											28,075														
Replace Condenser, Air-Cooled, 1 Ton																									23,186
Maintain Condensate Removal Pump System, 1/50 HP	59	59	59	59	59	59	59	59	59	59		59	59	59	59	59	59	59	59	59	59	59	59	59	59
Lubricate, Repack Gland, Valve, Non Drain, 10"	56	56	56	56		56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56
Repair Condenser, Air-Cooled, 1 Ton				6,135																					
Maintain Condenser, Air-Cooled, 1 Ton	840	840	840	840	840	840	840	840	840	840	840	840	840	840		840	840	840	840	840	840	840	840	840	840
Replace Ball Valve, 1"																									2,032
Replace Pipe & Fittings, 2" Steel (20% of Pipe)					1,296																				
Replace Valve, Non-Drain, 10"						11,669																			11,669
Replace 10' Section, Pipe & Fittings, 4" Steel	39																								39
Replace Steam Trap, F&T, 2"	33,955										33,955														33,955
Repair Steam Trap, F&T, 2"				15,473		15,473										15,473		15,473							15,473
Maintain Steam Trap, F&T, 2"		1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167		1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167		1,167	1,167	1,167	1,167	1,167
Install New Gasket & Bolts, Pipe & Fittings, 4" Steel																									
Re-tape Pipe Insulation, Fiberglass, Heating Water/Steam											91					91									91
Replace Pipe & Fittings, 10" Steel (20% of Pipe)					880																				
Install New Gasket & Bolts, Pipe & Fittings, 10" Steel																									
Replace 10' Section, Pipe & Fittings, 10" Steel	44																								44

M&R Costs by Task

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Replace Pipe & Fittings, 4" Steel (20% of Pipe)																										
Replace Pipe Insulation, Fiberglass, Heating Water/Steam (20				382																						
Lubricate, Repack Gland, Ball Valve, 1"	166	166	166	166		166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166		166	166	166	

D40 Fire Protection

Replace 10' Section, Pipe & Fittings, 1" Steel		60												60											
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel			46																						
Replace 10' Section, Pipe & Fittings, 2" Steel		18												18											
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel			10																						
Replace 10' Section, Pipe & Fittings, 4" Steel		19												19											
Install New Gasket & Bolts, Pipe & Fittings, 4" Steel			8																						
Replace Fire Extinguisher										2,383											2,383				
Repair Fire Alarm Control Panel								119					119										119		
Test Gages & Valves, Fire Sprinkler System	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697
Inspect & Test Fire Extinguisher			256					256						256						256					
Replace Fire Department Connection, Siamese, 3"																									
Replace Fire Sprinkler Head																									
Test Fire Sprinkler Head								4,589												4,589					
Replace Fire Alarm Control Panel			3,071																	3,071					
Inspect Fire Sprinkler Head	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92
Inspect & Test Fire Alarm Control Panel	129	129		129	129	129	129	129	129	129	129	129	129	129	129	129	129		129	129	129	129	129	129	129
Inspect & Maintain Fire Department Connection, Siamese, 3"	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
Replace Valves & Components, Sprinkler System																					3,210				
Maintain Fire Sprinkler System	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756

D50 Electrical

Repair Gas Monitoring System			41																		41				
Replace Batteries & Check Operation, Gas Monitoring System	18	18	18	18	18	18	18		18	18	18	18	18	18	18	18	18	18	18	18	18	18		18	18
Replace Wiring Device, Switch													1,027												
Repair Wiring Device, Switch			995																					995	
Replace Receptacle, 120 V, 15 Amp.														2,106							2,527				
Replace Metal Halide Lighting Fixture, Wall Mount, 150 w																					1,051				
Replace Gas Monitoring System									2,353														2,353		
Replace Lamp, Metal Halide Lighting Fixture, Wall Mount, 150			194						194				194											194	
Replace Manual Pull Station																					702				
Replace Incandescent Lighting Fixture, Basic, 100 w			275																					275	
Replace Lamp, Incandescent Lighting Fixture, Basic, 100 w									18				18								18				
Replace LED Lighting Fixture, 100 w																					665				

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Pipe & Fittings, 4" Steel (20% of Pipe)				788																					
Replace Pipe Insulation, Fiberglass, Heating Water/Steam (20				382																					
Lubricate, Repack Gland, Ball Valve, 1"	166	166	166	166	166	166	166	166	166	166	166	166	166			166	166	166	166	166	166	166	166	166	166

D40 Fire Protection

Replace 10' Section, Pipe & Fittings, 1" Steel	60																									60
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel			46																							
Replace 10' Section, Pipe & Fittings, 2" Steel	18																									18
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel			10																							
Replace 10' Section, Pipe & Fittings, 4" Steel	19																									19
Install New Gasket & Bolts, Pipe & Fittings, 4" Steel			8																							
Replace Fire Extinguisher									2,383												2,383					
Repair Fire Alarm Control Panel			119																			119				
Test Gages & Valves, Fire Sprinkler System	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697
Inspect & Test Fire Extinguisher		256						256						256												
Replace Fire Department Connection, Siamese, 3"			1,127																							
Replace Fire Sprinkler Head			10,031																							
Test Fire Sprinkler Head														4,589												4,589
Replace Fire Alarm Control Panel									3,071																	3,071
Inspect Fire Sprinkler Head	92	92		92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92
Inspect & Test Fire Alarm Control Panel	129	129	129	129	129	129	129		129	129	129	129	129	129	129	129	129	129	129	129	129	129			129	129
Inspect & Maintain Fire Department Connection, Siamese, 3"	113	113		113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
Replace Valves & Components, Sprinkler System																										3,210
Maintain Fire Sprinkler System	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756	756

D50 Electrical

Repair Gas Monitoring System									41																	41
Replace Batteries & Check Operation, Gas Monitoring System	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Replace Wiring Device, Switch			1,027																							1,027
Repair Wiring Device, Switch																										995
Replace Receptacle, 120 V, 15 Amp.									2,106																	2,527
Replace Metal Halide Lighting Fixture, Wall Mount, 150 w																										1,051
Replace Gas Monitoring System																										2,353
Replace Lamp, Metal Halide Lighting Fixture, Wall Mount, 150			194						194																	194
Replace Manual Pull Station									702																	702
Replace Incandescent Lighting Fixture, Basic, 100 w																										275
Replace Lamp, Incandescent Lighting Fixture, Basic, 100 w			18						18																	18
Replace LED Lighting Fixture, 100 w																										665

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Replace Ballast, Metal Halide Lighting Fixture, Wall Mount, 150								405																	
Replace Fire Alarm Bell, 6"								727																	
Replace Fire Alarm Horn & Strobe								710																	
Maintain Keypad	61	61	61	61	61	61	61		61	61	61	61	61	61	61	61	61		61	61	61	61	61	61	61
Check & Repair Manual Pull Station													303												
Maintain Public Address Speaker	120	120	120	120	120	120	120		120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Replace Public Address Speaker								1,674															1,674		
Replace Batteries & Check Operation, Smoke Detector	147	147		147	147	147	147	147	147	147	147	147	147	147	147	147	147		147	147	147	147	147	147	147
Replace Battery Charger																		3,435							
Repair Smoke Detector													333												
Replace Smoke Detector			1,193															1,193							
Repair Battery Charger		701		701		701		701		701		701		701		701				701		701		701	
Replace Disconnect Switch, 30 Amp.																		5,725							
Replace Lamp, LED Lighting Fixture, 100 w			229					229					229										229		
Replace Access Keypad								500										500							
Replace Power Panel Board, 208 Y/120 V, 225 Amp.								6,035																	
Maintain Disconnect Switch, 30 Amp.	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340		340	340	340	340	340	340	340
Repair Disconnect Switch, 30 Amp.								2,151																	
Maintain Disconnect Switch, 60 Amp.	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		40	40	40	40	40	40	40
Replace Disconnect Switch, 60 Amp.																		1,483							
Maintain Power Panel Board, 208 Y/120 V, 100 Amp.	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
Repair Power Panel Board, 208 Y/120 V, 100 Amp.								194										194							
Replace Power Panel Board, 208 Y/120 V, 100 Amp.																									
Repair Disconnect Switch, 60 Amp.								260																	
Repair Power Panel Board, 208 Y/120 V, 225 Amp.																		97							
Replace Fluorescent Lighting Fixture, T8, 4-32 w			2,349																				2,349		
Maintain Primary Transformer, Dry, 500 kVA	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Repair Primary Transformer, Dry, 500 kVA													301												
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 2-3													14,419												
Maintain Power Panel Board, 208 Y/120 V, 225 Amp.	61	61	61	61	61	61	61		61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 4-3													1,474												
Replace Primary Transformer, Dry, 500 kVA																									
Replace Exit Lighting Fixture, w/ Battery								1,655																	
Replace Lamp, Exit Lighting Fixture, w/ Battery			361															361						361	
Replace Emergency Lighting Pack, 2 Light w/ Battery													9,129												
Replace Lens, Replace Emergency Lighting Pack, 2 Light w/ Ba			290																				290		
Replace Lamp, Replace Emergency Lighting Pack, 2 Light w/ B	581		581		581		581		581		581				581		581		581		581		581		581

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Ballast, Metal Halide Lighting Fixture, Wall Mount, 15			405																				405		
Replace Fire Alarm Bell, 6"			727																				727		
Replace Fire Alarm Horn & Strobe			710																				710		
Maintain Keypad	61	61		61	61	61	61	61	61	61	61	61		61	61	61	61	61	61	61	61	61		61	61
Check & Repair Manual Pull Station			303																						
Maintain Public Address Speaker	120	120	120	120	120	120	120	120	120	120	120	120		120	120	120	120	120	120	120	120	120	120	120	120
Replace Public Address Speaker																1,674									
Replace Batteries & Check Operation, Smoke Detector	147	147	147	147	147	147	147		147	147	147	147	147	147	147	147	147	147	147	147	147	147		147	147
Replace Battery Charger																3,435									
Repair Smoke Detector			333																333						
Replace Smoke Detector								1,193															1,193		
Repair Battery Charger	701	701		701	701	701	701	701	701	701	701			701	701	701	701	701	701	701	701	701		701	701
Replace Disconnect Switch, 30 Amp.																									
Replace Lamp, LED Lighting Fixture, 100 w			229					229											229					229	
Replace Access Keypad			500													500								500	
Replace Power Panel Board, 208 Y/120 V, 225 Amp.																6,035									
Maintain Disconnect Switch, 30 Amp.	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340
Repair Disconnect Switch, 30 Amp.			2,151													2,151								2,151	
Maintain Disconnect Switch, 60 Amp.	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Replace Disconnect Switch, 60 Amp.																									
Maintain Power Panel Board, 208 Y/120 V, 100 Amp.	121	121		121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
Repair Power Panel Board, 208 Y/120 V, 100 Amp.																194								194	
Replace Power Panel Board, 208 Y/120 V, 100 Amp.			7,898																						
Repair Disconnect Switch, 60 Amp.			260													260								260	
Repair Power Panel Board, 208 Y/120 V, 225 Amp.			97																					97	
Replace Fluorescent Lighting Fixture, T8, 4-32 w																									2,349
Maintain Primary Transformer, Dry, 500 kVA	61	61		61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Repair Primary Transformer, Dry, 500 kVA																									301
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 2-																14,419									
Maintain Power Panel Board, 208 Y/120 V, 225 Amp.	61	61	61	61	61	61	61	61	61	61	61	61		61	61	61	61	61	61	61	61	61	61	61	61
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 4-																1,474									
Replace Primary Transformer, Dry, 500 kVA			53,292																						
Replace Exit Lighting Fixture, w/ Battery			1,655																					1,655	
Replace Lamp, Exit Lighting Fixture, w/ Battery								361						361					361						
Replace Emergency Lighting Pack, 2 Light w/ Battery								9,129																	
Replace Lens, Replace Emergency Lighting Pack, 2 Light w/																									290
Replace Lamp, Replace Emergency Lighting Pack, 2 Light w/		581		581		581					581			581				581			581				581

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Replace Secondary Transformer, Dry, 150 kVA																										
Repair Secondary Transformer, Dry, 150 kVA								271										271								
Maintain Secondary Transformer, Dry, 150 kVA	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	
Replace Fluorescent Lighting Fixture, T8, 2-32 w			22,990																					22,990		

E10 Equipment

Maintain Icemaker, Commercial	813	813	813	813	813	813	813		813	813	813	813	813	813	813	813	813		813	813	813	813	813	813	813
Replace Icemaker, Commercial								16,685										16,685							
Replace Microwave Oven								547										547							
Maintain Refrigerator, Domestic	38	38	38	38	38	38	38		38	38	38	38	38	38	38	38	38		38	38	38	38	38	38	38
Replace Refrigerator, Domestic								1,385										1,385							

G30 Site Mechanical Utilities

Replace Post Indicator Valve														2,562											
Inspect & Test Post Indicator Valve	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59

M&R Costs by Task

Whitestone Research

23-Dec-14

Building: Distribution Center

Facility: Langley Research Center

Building Num: 1206

City: Hampton, VA

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Secondary Transformer, Dry, 150 kVA						11,773																			
Repair Secondary Transformer, Dry, 150 kVA																271									271
Maintain Secondary Transformer, Dry, 150 kVA	61	61		61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Replace Fluorescent Lighting Fixture, T8, 2-32 w																									22,990

E10 Equipment

Maintain Icemaker, Commercial	813	813		813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813
Replace Icemaker, Commercial						16,685										16,685									16,685
Replace Microwave Oven						547										547									547
Maintain Refrigerator, Domestic	38	38		38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Replace Refrigerator, Domestic						1,385										1,385									1,385

G30 Site Mechanical Utilities

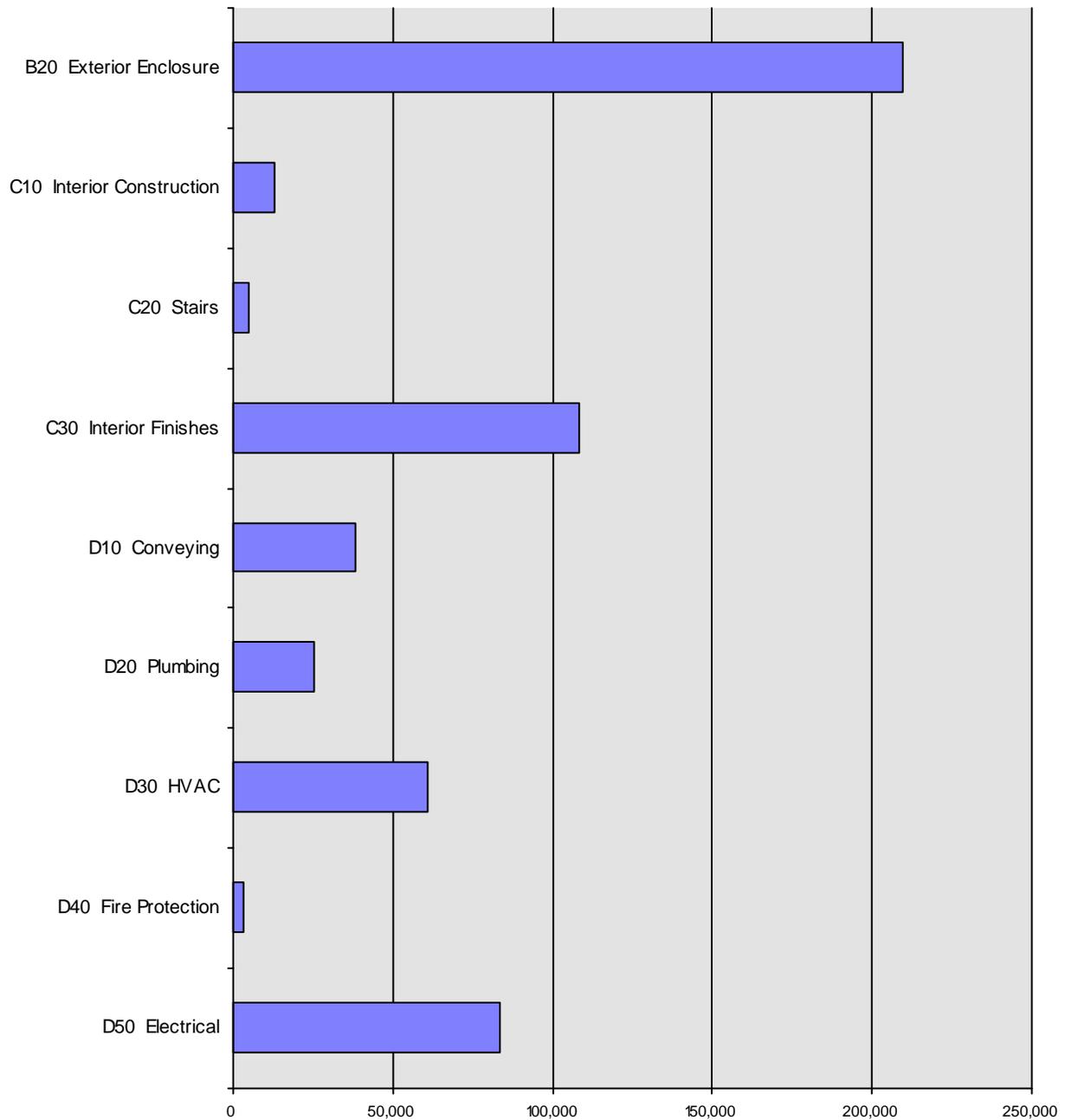
Replace Post Indicator Valve																									2,562
Inspect & Test Post Indicator Valve	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59

Building Deferred Maintenance by System Chart

Building: Distribution Center

Building Num: 1206

City: Hampton, VA



All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral and is included in Total Deferred Maintenance.

Based on a 50-Year Forecast.

Building Deferred Maintenance Detail

Whitestone Research

Building: Distribution Center **Year Built:** 1966 **Building Type:** Temperature Controlled Warehouse
Facility: Langley Research Center **Original Cost:** \$1
City: Hampton, VA **Replacement Value:** \$3,639,735 **Building Gsft:** 35,625
 per SF: \$102 **Building Number:** 1206

Year Installed	Years Deferred	Deferred Maintenance Task*	Deferred* Maintenance	Degradation Cost**	Total Deferred Maintenance
1966	7	Replace Steel, Insulated Wall Panels, Painted, Exterior, 2"	\$209,722	\$0	\$209,722
1966	17	Replace Metal Floor Grating	\$65,438	\$0	\$65,438
1980	3	Replace Primary Transformer, Dry, 500 kVA	\$53,292	\$0	\$53,292
1966	22	Replace Dock Ramp Leveler	\$38,427	\$0	\$38,427
1966	38	Replace Steam Trap, F&T, 2"	\$33,955	\$0	\$33,955
1966	39	Replace Carpet, Nylon 20 oz., High Traffic	\$12,931	\$0	\$12,931
1980	3	Replace Secondary Transformer, Dry, 150 kVA	\$11,773	\$0	\$11,773
1966	28	Replace Valve, Non-Drain, 10"	\$11,669	\$0	\$11,669
1966	17	Replace Wood, Hollow Core, Painted, Interior Door	\$9,949	\$0	\$9,949
1980	3	Replace Power Panel Board, 208 Y/120 V, 100 Amp.	\$7,898	\$0	\$7,898
1966	39	Replace Carpet, Nylon 20 oz., High Traffic	\$7,793	\$0	\$7,793
1966	39	Replace Carpet, Nylon 20 oz., High Traffic	\$7,476	\$0	\$7,476
1966	39	Replace Carpet, Nylon 20 oz., High Traffic	\$6,935	\$0	\$6,935
1966	39	Replace Carpet, Nylon 20 oz., High Traffic	\$5,622	\$0	\$5,622
1966	17	Replace Metal, Painted, Exterior Railing	\$4,868	\$0	\$4,868
1995	8	Replace Water Cooler, Electric	\$4,505	\$0	\$4,505
1966	28	Replace Gate Valve, 6"	\$4,309	\$0	\$4,309
1966	28	Replace Exhaust Fan, Propeller, 1,000 Cfm	\$3,950	\$0	\$3,950
1966	12	Replace Tankless Water Closet	\$3,657	\$0	\$3,657
2000	3	Replace Backflow Preventer, 2"	\$3,556	\$0	\$3,556
1990	3	Replace Battery Charger	\$3,435	\$0	\$3,435
1990	3	Replace Valves & Components, Sprinkler System	\$3,210	\$0	\$3,210
1966	27	Replace Toilet Partitions, Painted Metal, Overhead Braced	\$3,205	\$0	\$3,205
1994	9	Replace Thermostat	\$3,184	\$0	\$3,184
1966	12	Replace Urinal, Vitreous China	\$2,914	\$0	\$2,914
1990	3	Replace Receptacle, 120 V, 15 Amp.	\$2,527	\$0	\$2,527
1966	12	Replace Lavatory, Vitreous China	\$2,165	\$0	\$2,165
1966	27	Replace Receptacle, 120 V, 15 Amp.	\$2,106	\$0	\$2,106
1966	30	Replace Ball Valve, 1"	\$2,032	\$0	\$2,032
1990	8	Replace Public Address Speaker	\$1,674	\$0	\$1,674
1966	41	Replace Pressure Reducer Valve, 2"	\$1,562	\$0	\$1,562
1966	22	Replace Pipe & Fittings, 3/4" Copper, Hot Water (20% of Pipe)	\$1,313	\$0	\$1,313
1966	22	Replace Pipe & Fittings, 3/4" Copper, Cold Water (20% of Pipe)	\$1,313	\$0	\$1,313

All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

Based on a 50-Year Forecast.

23-Dec-14

Building Deferred Maintenance Detail

Whitestone Research

Building: Distribution Center	Year Built: 1966	Building Type: Temperature Controlled Warehouse
Facility: Langley Research Center	Original Cost: \$1	
City: Hampton, VA	Replacement Value: \$3,639,735	Building Gsft: 35,625
	per SF: \$102	Building Number: 1206

Year Installed	Years Deferred	Deferred Maintenance Task*	Deferred* Maintenance	Degradation Cost**	Total Deferred Maintenance
1966	7	Replace Plywood Ceiling	\$1,168	\$0	\$1,168
1966	39	Replace Carpet, Nylon 20 oz., High Traffic	\$1,068	\$0	\$1,068
1966	32	Replace Water Heater, Electric, 15 Gal.	\$1,040	\$0	\$1,040
1995	3	Replace Wiring Device, Switch	\$1,027	\$0	\$1,027
1966	12	Replace Service Sink, Iron, Enamel	\$962	\$0	\$962
1966	7	Replace Sink, Stainless Steel	\$939	\$0	\$939
2000	3	Replace Backflow Preventer, 3/4"	\$827	\$0	\$827
1966	22	Replace Emergency Eye Wash Station	\$772	\$0	\$772
1966	32	Replace Water Heater, Electric, 5 Gal.	\$714	\$0	\$714
1966	22	Replace Pipe Insulation, Fiberglass, Heating Water/Steam (20% of	\$382	\$0	\$382
1966	7	Replace Floor Drain	\$283	\$0	\$283
1966	22	Replace Pipe Insulation, Fiberglass, Cold Water (20% of Insulation	\$274	\$0	\$274
1966	22	Replace Pipe Insulation, Fiberglass, Hot Water (20% of Insulation)	\$274	\$0	\$274
1966	37	Replace Valve, Hose Bib	\$52	\$0	\$52
Total			\$548,143	\$0	\$548,143

All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

Based on a 50-Year Forecast.

23-Dec-14

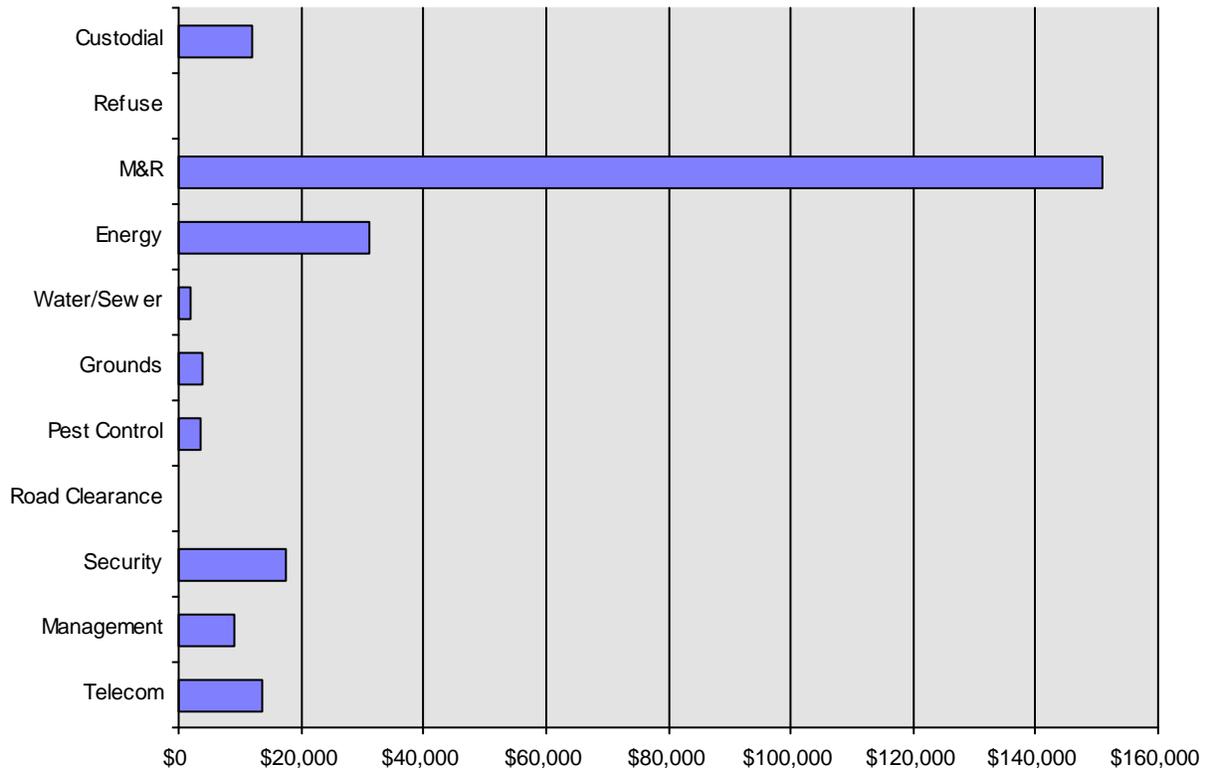
Operation Costs Summary

Whitestone Research

Building: Distribution Center
Building Number: 1206
Facility: Langley Research Center
City: Hampton, VA
Built Date: 1966

GSFT: 35,625
Replacement Value: \$3,639,735
Building Use: Warehouse and Storage
Building Type: Temperature Controlled Warehouse

Operation	Annual Cost/GSFT	Annual Total	Percent
Custodial	\$0.333	\$11,852	4.9%
Energy	\$0.873	\$31,116	12.8%
Grounds	\$0.110	\$3,902	1.6%
M&R	\$4.240	\$151,054	61.9%
Management	\$0.255	\$9,099	3.7%
Pest Control	\$0.104	\$3,688	1.5%
Refuse	\$0.006	\$205	0.1%
Road Clearance	\$0.006	\$216	0.1%
Security	\$0.489	\$17,408	7.1%
Telecom	\$0.379	\$13,506	5.5%
Water/Sewer	\$0.054	\$1,929	0.8%
Building Total	\$6.85	\$243,975	100.0%



Building Operations Utility Details

Whitestone Research

Building: Distribution Center

Year Built: 1966

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1206

City: Hampton, VA

Replacement Value: \$3,639,735 **per SF:** \$102

Building Gsft: 35,625

		Utility	GSFT	Demand	UM	Rate	Cost
Operation:	Energy	Level of Service: Medium					
		Electricity	35625	10.791	kWh	\$0.0700	\$26,910
		Natural Gas	35625	0.158	Thm	\$0.7480	\$4,206
		Diesel	35625	0.000	Gal	\$3.1876	\$0
		Total:		10.949			\$31,116
Operation:	Refuse	Level of Service: Medium					
		Municipal Solid Waste	35625	0.070	Lbs	\$0.0674	\$168
		Recycling	35625	0.030	Lbs	\$0.0348	\$37
		Total:		0.100			\$205
Operation:	Water/Sewer	Level of Service: Medium					
		Water	35625	7.280	Gal	\$0.0056	\$1,452
		Sewer	35625	5.720	Gal	\$0.0023	\$477
		Total:		13.000			\$1,929

Building Operations Task Details

Whitestone Research

Building: Distribution Center

Year Built: 1966

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1206

City: Hampton, VA

Replacement Value: \$3,639,735 **per SF:** \$102

Building Gsft: 35,625

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Custodial		Level of Service: Low			
Warehouse	13181	Sweep Hard Floor with 48" Push Broom	\$238	\$39	\$276
Warehouse	13181	Empty Trash; Wipe Clean & Re-line Basket	\$152	\$25	\$177
Logistics/Distribution	10687	Sweep Hard Floor with 48" Push Broom	\$193	\$31	\$224
Logistics/Distribution	10687	Empty Trash; Wipe Clean & Re-line Basket	\$123	\$20	\$144
Office	7125	Vacuum Carpet with 14" Upright Vacuum	\$2,497	\$406	\$2,902
Office	7125	Empty Trash; Wipe Clean & Re-line Basket	\$713	\$116	\$829
Office	7125	Clean and Wipe Furniture with Trigger Sprayer & Cloth	\$438	\$71	\$509
Office	7125	Dust Surfaces with Duster	\$329	\$53	\$383
Office	7125	Vacuum Upholstered Furniture with Tank or Canister Vacuum	\$274	\$45	\$319
Office	7125	Dust Window Blinds	\$158	\$26	\$184
Restroom	1781	Service Restroom: Empty Trash, Clean & Disinfect Fixtures, Wipe Mirrors, Replace Supplies, Wet	\$3,744	\$608	\$4,353
Restroom	1781	Service Restroom: Empty Trash, Replace Supplies & Touch Up as Needed	\$574	\$93	\$667
Shop	1425	Damp Mop Hard Floors with 24 oz. Mop Head Using Double Bucket & Wringer	\$522	\$85	\$607
Shop	1425	Empty Trash; Wipe Clean & Re-line Basket	\$198	\$32	\$230
Mechanical/Equipment	1425	Sweep Hard Floor with 48" Push Broom	\$26	\$4	\$30
Mechanical/Equipment	1425	Empty Trash; Wipe Clean & Re-line Basket	\$16	\$3	\$19
Total:			\$10,195	\$1,657	\$11,852
Operation: Grounds		Level of Service: Low			
Grounds, Improved	21375	Mow Turfgrass with 21" Power Mower	\$748	\$311	\$1,059
Grounds, Improved	21375	Aerate Improved Grounds	\$508	\$211	\$719
Grounds, Improved	21375	Clear Shrubs	\$424	\$176	\$600
Grounds, Improved	21375	Edge Clean & Trim Walks with Gas Powered Edger	\$310	\$129	\$439
Grounds, Improved	21375	Overseed, Improved Grounds	\$254	\$106	\$359
Grounds, Improved	21375	Vacuum with 30" Billy Goat	\$170	\$71	\$240
Grounds, Improved	21375	Clear Crabgrass	\$127	\$53	\$180
Grounds, Improved	21375	Clear Weeds with 15" Boom, Improved Grounds	\$68	\$28	\$96
Grounds, Improved	21375	Trim Around Raised Objects with String Edger	\$64	\$26	\$90

All costs expressed in (\$) 2012.

23-Dec-14

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Grounds, Improved	21375	Fertilize Improved Grounds	\$51	\$21	\$72
Grounds, Improved	21375	Sweep with 30" Power Rake	\$34	\$14	\$47
Grounds, Improved	21375	Fertilize Using Power Take Off Broadcast	\$0	\$0	\$0
Total:			\$2,755	\$1,146	\$3,902
Operation: Pest Control		Level of Service: Medium			
Pest Controlled	35625	Install, or Check and Re-Bait 5 Rodent Boxes	\$1,273	\$530	\$1,803
Pest Controlled	35625	Perform Crawling Insect Abatement	\$956	\$398	\$1,354
Pest Controlled	35625	Inspect Building for Pests	\$531	\$0	\$531
Total:			\$2,761	\$927	\$3,688
Operation: Road Clearance		Level of Service: Medium			
Pavement NASA	28500	Plow Paved Area	\$166	\$50	\$216
Total:			\$166	\$50	\$216
Operation: Security		Level of Service: Medium			
Secured Area	35625	Patrol Building Perimeter	\$5,262	\$855	\$6,117
Secured Area	35625	Guard Lobby/Parking	\$0	\$0	\$0
Total:			\$5,262	\$855	\$6,117

Building Operations Service Details

Whitestone Research

Building: Distribution Center	Year Built: 1966	FTEs: 15	Building Type: Temperature Controlled W
Facility: Langley Research Center	Original Cost: \$1		Building Num: 1206
City: Hampton, VA	Replacement Value: \$3,639,735	per SF: \$102	Building Gsft: 35,625

		Service*	Quantity	Rate	Cost
Operation:	Security	Level of Service: Medium			
		Intrusion Detection Systems	1	\$4,986	\$4,986
		System Monitoring	1	\$3,615	\$3,615
		Access Control	1	\$2,690	\$2,690
		Total:			\$11,291
Operation:	Telecom	Level of Service: High			
		Local Telephone	15	\$468	\$7,020
		Data	15	\$3,588	\$3,606
		Long Distance Telephone	15	\$192	\$2,880
		Total:			\$13,506

Building Operations Management Details

Whitestone Research

Building: Distribution Center

Year Built: 1966

Building Type: Temperature Controlled W

Facility: Langley Research Center

Original Cost: \$1

Building Num: 1206

City: Hampton, VA

Replacement Value: \$3,639,735 **per SF:** \$102

Building Gsft: 35,625

	Service	Demand	UM	PRV	Cost
Operation: Management	Level of Service: Low				
	Management	0.3%	PRV	\$3,639,735	\$9,099
	Total:				\$9,099

Attachment E: Detailed MARS Reports for PBS Igloo Model

Average M&R Costs

Whitestone Research

Plum Brook Igloo
Building Number: Igloo
Facility: Plum Brook Station
City: Cleveland, OH

GSFT: 1,953
PRV: \$309,368
Built Date: 1942

M&R Average Annual Cost Forecasts

	Current Year	5 Year	20 Year	50 Year
PM & Minor Repair:	\$0	\$0	\$3	\$3
Unscheduled Maintenance:	\$0	\$0	\$4	\$6
Renewal & Replacement:	\$0	\$17,918	\$4,536	\$1,889
Total M&R Costs:	\$0	\$17,918	\$4,543	\$1,898
Per GSFT:	\$0.00	\$9.17	\$2.33	\$0.97
As % of PRV:	0.00%	5.79%	1.47%	0.61%

Building Component List

Whitestone Research

Building: Plum Brook Igloo

Year Built: 1942

Building Type: Non-Temperature Control

Facility: Plum Brook Station

Original Cost: \$1

Building Num: Igloo

City: Cleveland, OH

Replacement Value: \$309,368

per SF: \$158

Building Gsft: 1,953

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B2030		Steel, Exterior Door	1942	1 Each		
C3020		Concrete Flooring	1942	1950 Sq Ft		
C3030		Concrete Ceiling	1942	2665 Sq Ft		
D3040		Ventilator, 12"	1942	1 Each		

Building Extended Component List with Remaining Service Life

Whitestone Research

30-Apr-15

Building: Plum Brook Igloo

Year Built: 1942

Building Type: Non-Temperature Control

Facility: Plum Brook Station

Original Cost: \$1

Building Num: Igloo

City: Cleveland, OH

Replacement Value: \$309,368

per SF: \$158

Building Gsft: 1,953

Uniformat	Asset Description	Component	Year Built	Remaining Service Life*	Quantity	Deferred** Maintenance	Degradation Cost***	Total Deferred Maintenance	Location	Notes
B2030		Steel, Exterior Door	1942	3	1 Each					
C3020		Concrete Flooring	1942	3	1950 Sq Ft					
C3030		Concrete Ceiling	1942	3	2665 Sq Ft					
D3040		Ventilator, 12"	1942	-46	1 Each	\$271	\$0	\$271		

*Remaining Service Life shows years until scheduled Replacement Task; blank implies there is no Replacement Task.

All costs expressed in (\$) 2012.

**Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

Forecast Year: 2013

***Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

M&R Costs by System per Year Chart

Whitestone Research

30-Apr-15

Building: Plum Brook Igloo

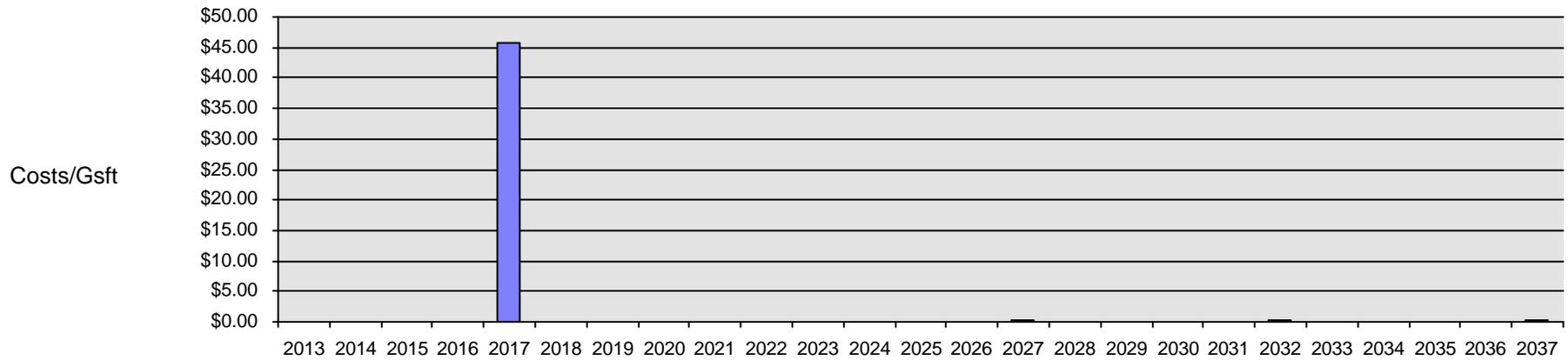
Facility: Plum Brook Station

City: Cleveland, OH

1953

Forecast Year: 2013 4 5 6 7 2018 9 0 1 2 2023 4 5 6 7 2028 9 0 1 2 2033 4 5 6 7

System	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	
A10 Foundations																										
A20 Basement Construction																										
B10 Super Structure																										
B20 Exterior Enclosure					0.46					0.03					0.19						0.12					0.19
B30 Roofing																										
C10 Interior Construction																										
C20 Stairs																										
C30 Interior Finishes					45.42																0.18					
D10 Conveying																										
D20 Plumbing																										
D30 HVAC									0.14																	
D40 Fire Protection																										
D50 Electrical																										
E10 Equipment																										
E20 Furnishings																										
F10 Special Construction																										
F20 Selective Bldg Demolition																										
G10 Site Preparation																										
G20 Site Improvements																										
G30 Site Mechanical Utilities																										
G40 Site Electrical Utilities																										
G90 Other Site Construction																										
Total					45.87				0.14		0.03				0.19					0.31						0.19

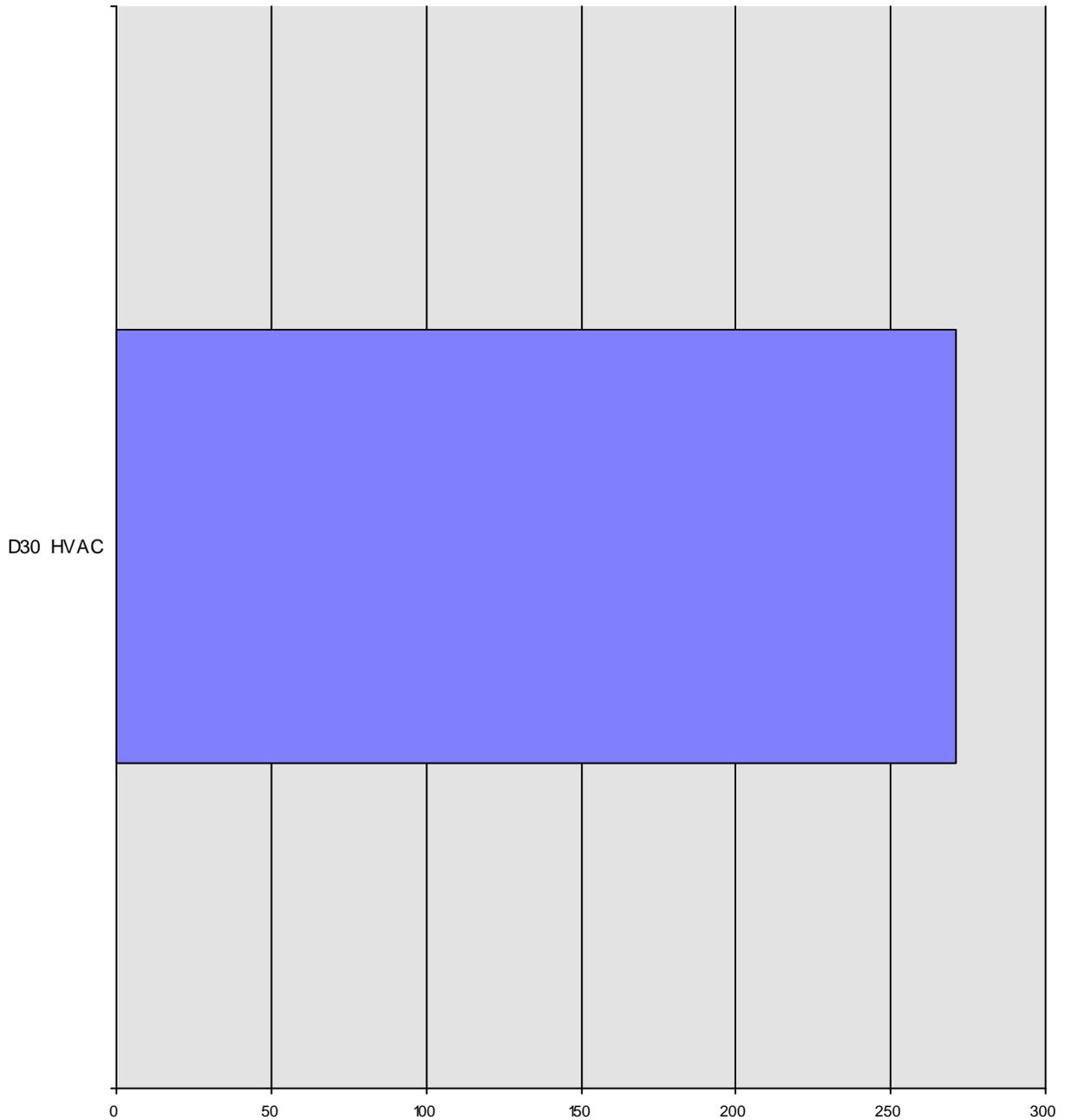


Notes: A value of "0.00" means cost of more than \$.000 but less than \$.005 per gsft. All costs expressed in (\$) 2012 per gsft. Based on a 50-Year Forecast.

Building Deferred Maintenance by System Chart

Building: Plum Brook Igloo

Building Num: Igloo



All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral and is included in Total Deferred Maintenance.

Based on a 50-Year Forecast.

30-Apr-15

Building Deferred Maintenance Detail

Whitestone Research

Building: Plum Brook Igloo	Year Built: 1942	Building Type: Non-Temperature Controlled
Facility: Plum Brook Station	Original Cost: \$1	
City: Cleveland, OH	Replacement Value: \$309,368	Building Gsft: 1,953
	per SF: \$158	Building Number: Igloo

Year Installed	Years Deferred	Deferred Maintenance Task*	Deferred* Maintenance	Degradation Cost**	Total Deferred Maintenance
1942	45	Replace Ventilator, 12"	\$271	\$0	\$271
Total			\$271	\$0	\$271

All costs expressed in (\$) 2012.

Forecast Year: 2013

*Deferred Maintenance is defined as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the Forecast Year. Preventative maintenance and minor repairs are not included.

**Degradation Cost is defined as additional cost (penalty cost) incurred by maintenance deferral.

Based on a 50-Year Forecast.

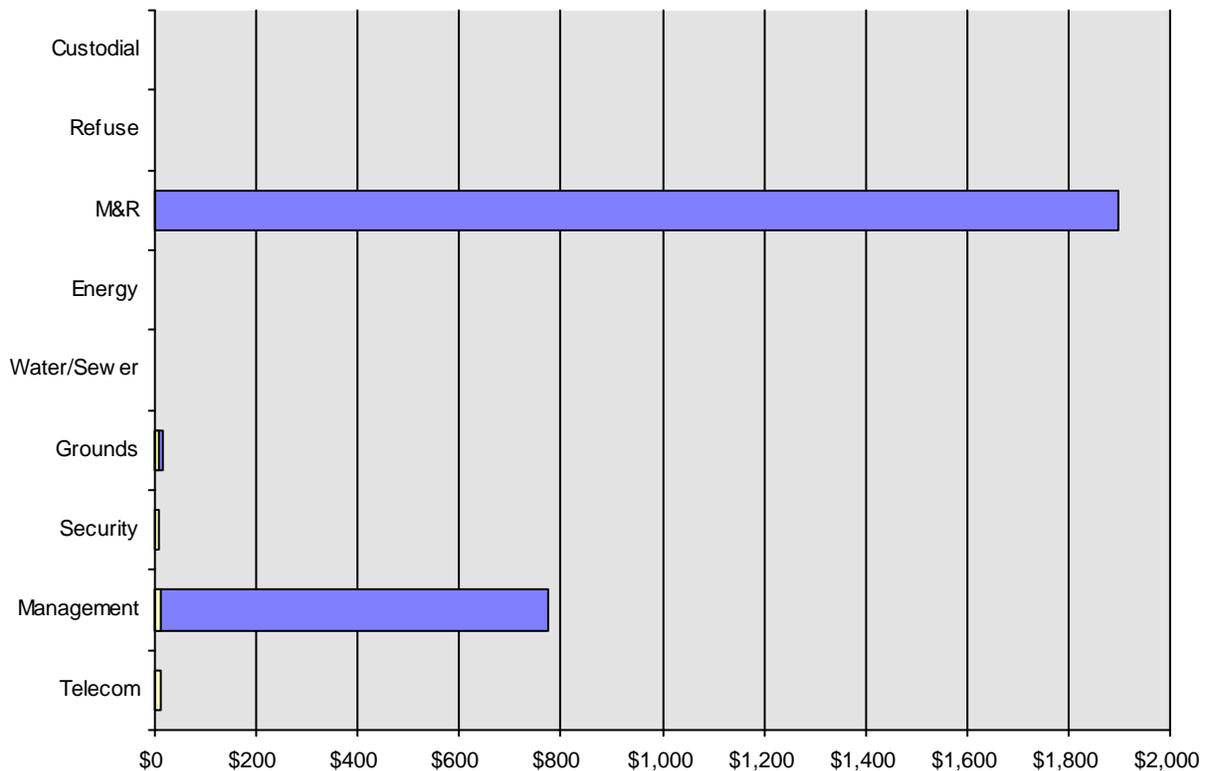
Operation Costs Summary

Whitestone Research

Building: Plum Brook Igloo
Building Number: Igloo
Facility: Plum Brook Station
City: Cleveland, OH
Built Date: 1942

GSFT: 1,953
Replacement Value: \$309,368
Building Use: Warehouse and Storage
Building Type: Non-Temperature Controlled Warehouse

Operation	Annual Cost/GSFT	Annual Total	Percent
Custodial	\$0.000	\$0	0.0%
Energy	\$0.000	\$0	0.0%
Grounds	\$0.008	\$15	0.5%
M&R	\$0.972	\$1,899	70.7%
Management	\$0.396	\$773	28.8%
Refuse	\$0.000	\$0	0.0%
Security	\$0.000	\$0	0.0%
Telecom	\$0.000	\$0	0.0%
Water/Sewer	\$0.000	\$0	0.0%
Building Total	\$1.38	\$2,687	100.0%



Building Operations Utility Details

Whitestone Research

Building: Plum Brook Igloo
Facility: Plum Brook Station
City: Cleveland, OH

Year Built: 1942
Original Cost: \$1
Replacement Value: \$309,368 **per SF:** \$158

Building Type: Non-Temperature Control
Building Num: Igloo
Building Gsft: 1,953

		Utility	GSFT	Demand	UM	Rate	Cost
Operation:	Energy	Level of Service: None					
		Diesel	1953	0.000	Gal	\$3.2669	\$0
		Natural Gas	1953	0.000	Thm	\$0.4800	\$0
		Electricity	1953	0.000	kWh	\$0.0700	\$0
		Total:		0.000			\$0
Operation:	Refuse	Level of Service: None					
		Recycling	1953	0.000	Lbs	\$0.0363	\$0
		Municipal Solid Waste	1953	0.000	Lbs	\$0.0063	\$0
		Total:		0.000			\$0
Operation:	Water/Sewer	Level of Service: None					
		Sewer	1953	0.000	Gal	\$0.0036	\$0
		Water	1953	0.000	Gal	\$0.0153	\$0
		Total:		0.000			\$0

Building Operations Task Details

Whitestone Research

Building: Plum Brook Igloo

Year Built: 1942

Building Type: Non-Temperature Control

Facility: Plum Brook Station

Original Cost: \$1

Building Num: Igloo

City: Cleveland, OH

Replacement Value: \$309,368

per SF: \$158

Building Gsft: 1,953

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Custodial		Level of Service: None			
Storage	1953	None	\$0	\$0	\$0
Total:			\$0	\$0	\$0
Operation: Grounds		Level of Service: Low			
Grounds, Semi-Improve	1171	Mow Turfgrass with 5-7' Gang Reel	\$4	\$2	\$6
Grounds, Semi-Improve	1171	Aerate Semi-Improved Grounds	\$3	\$1	\$4
Grounds, Semi-Improve	1171	Clear Weeds with 15" Boom, Semi-Improved Grounds	\$2	\$1	\$2
Grounds, Semi-Improve	1171	Fertilize Semi-Improved Grounds	\$2	\$1	\$2
Total:			\$10	\$4	\$15

Building Operations Service Details

Whitestone Research

Building: Plum Brook Igloo

Year Built: 1942

FTEs: 0

Building Type: Non-Temperature Control

Facility: Plum Brook Station

Original Cost: \$1

Building Num: Igloo

City: Cleveland, OH

Replacement Value: \$309,368

per SF: \$158

Building Gsft: 1,953

	Service*	Quantity	Rate	Cost
Operation: Security	Level of Service: None			
	Access Control	0	\$2,690	\$0
	Total:			\$0
Operation: Telecom	Level of Service: None			
	Local Telephone	0	\$468	\$0
	Total:			\$0

Building Operations Management Details

Whitestone Research

Building: Plum Brook Igloo

Year Built: 1942

Building Type: Non-Temperature Control

Facility: Plum Brook Station

Original Cost: \$1

Building Num: Igloo

City: Cleveland, OH

Replacement Value: \$309,368

per SF: \$158

Building Gsft: 1,953

	Service	Demand	UM	PRV	Cost
Operation: Management	Level of Service: Low				
	Management	0.3%	PRV	\$309,368	\$773
	Total:				\$773
